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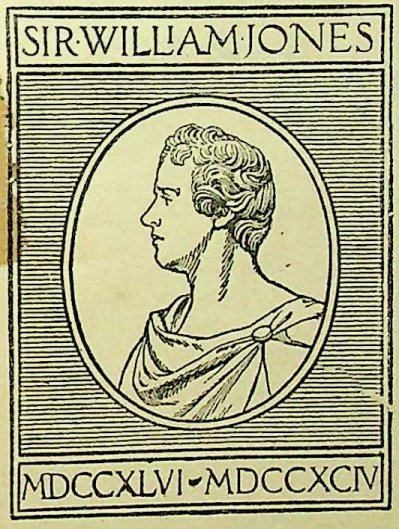

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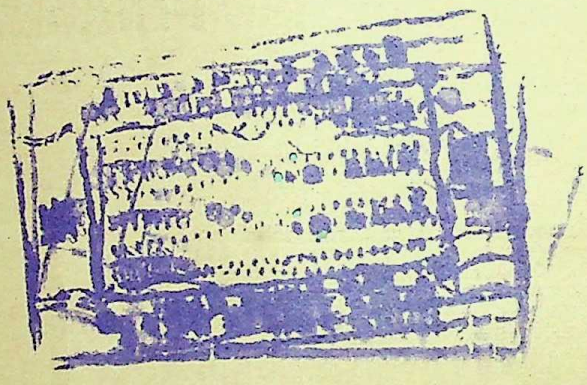

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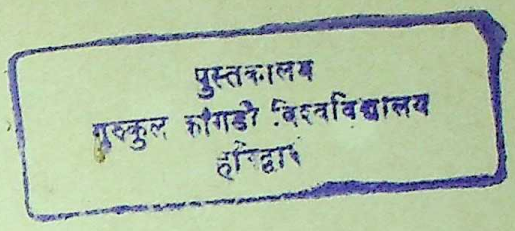

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1. The Chronology of the Pāla Kings.

By R. C. Majumdar, M.A., Ph.D.

The chronology of the Pāla kings has, for a long time, formed a subject of keen discussion. It will serve no useful purpose to recount the earlier views on the subject, as they were necessarily based upon insufficient materials and erroneous data. The first systematic attempt to reconstruct the main outline of the Pāla chronology on a reliable basis was made by the late Dr. V. A. Smith in 1909.[1] In the following year M.M. Haraprasād Śāstrī made a useful contribution about the initial date of Dharmapāla in his Introduction to Rāmacarita.[2] The subject was next seriously taken up by Mr. Ramaprasad Chanda and Mr. R. D. Banerji. Mr. Chanda's Bengali work 'Gauḍa-rāja-mālā' appeared in 1912–3, although the views expressed therein about the Pāla Chronology were somewhat modified four years later.[3] Mr. Banerji's 'Pālas of Bengal'[4] was published in 1915, but his views were re-stated, with substantial modifications, in his Bengali work 'Bānglār Itihāsa' published in the Bengali year 1321 (1914-15 A.D.). The only contribution that has since been made to our knowledge of the Pāla chronology is a paper by Mr. Banerji[5] in which, among other things, a short account is given of an inscription of the 24th year of Rājyapāla.

In discussing the views of Dr. Smith it must be remem-

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1 *Ind. Ant.*, 1909, p. 233
2 *Memoirs of the Asiatic Society of Bengal*, Vol. III.
3 *Mānasī* (a Bengali Monthly), Vol. VII, part I, pp. 577 ff., 657 ff.
4 *Memoirs of the Asiatic Society of Bengal*, Vol. V.
5 *Ind. Ant.*, 1918, p. 109.

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bered that some of the most important inscriptions were unknown to him. Thus the Uddaṇḍapura inscription of Nārāyaṇapāla[1] shows that the king ruled for at least 54 years, and this alone is liable to upset the chronological scheme put forward by him. But, even apart from this, his views are liable to serious objections. According to his scheme the first three kings ruled from 735 to 892 A.D., i.e. for a period of more than 150 years and this can hardly be accepted, even as a working hypothesis, unless very strong evidence is forthcoming in support of it. Dr. V. A. Smith rejected the Puranic statement that two generations of Nanda kings ruled for 100 years and assigned fifty years as a more reasonable period. His views about the duration of the reigns of the first three kings of the Pāla dynasty are not, therefore, consistent with his own principle. In the circumstances it is difficult to accept the contention of Dr. Smith, made as late as 1914, that the main outline of the Pāla chronology has been firmly laid by him.

Mr. Chanda's views about the dates of the first eight kings are no longer tenable. According to him, Vigrahapāla I ascended the throne in 900 A.D. and Vigrahapāla II, a few years before 965 A.D. But this is quite incompatible with the known reign-periods of the intervening kings, i.e. 54 years of Nārāyaṇapāla, 24 years of Rājyapāla and a longer[2] period of Gopāla II. This shows that his proposed dates for Dharmapāla and Devapāla require to be considerably pushed back.

As regards Mr. Banerji's theory, it is impossible to reconcile its different parts with one another. Thus he holds that the Pāla king defeated by Rāṣṭrakūṭa Kṛiṣṇa II was Rājyapāla, and as he has himself assumed in his Bānglār Itihāsa (pp. 189, 199, 203) that Vigrahapāla I ascended the throne in 865 A.D. and that his son Nārāyaṇapāla ruled for about 55 years, Rājyapāla could not possibly have ascended the throne before 920 A.D. But not only the reign of Kṛiṣṇa II but that of his two successors was over by that date, as Govinda IV, the great-grandson of Kṛiṣṇa II, and the fourth in succession from him, was ruling in 918 A.D. Again, Mr. Banerji looks upon Gopāla II, son of Rājyapāla, as a contemporary of Indra III, the grandson of Kṛiṣṇa II (*ibid.*, p. 204), and this is, of course, for reasons just stated, equally impossible. Further, according to Mr. Banerji, Madanapāla, the seventeenth king, was a contemporary of the Gāharwal king Candradeva (*ibid.*, p. 284) and must therefore have ascended the throne before 1097 A.D., the year in which the latter died. Now this is hopelessly irreconcilable with his view that the eleventh king Vigrahapāla III, who ruled for at least 13

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[1] *Ibid.*

[2] Evidence in support of this assumption is cited later, p. 4.

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years, ascended the throne in 1045 A.D. and that the fourteenth king Rāmapāla ruled for 45 years; for even if we ignore the reign-periods of the 12th, 13th, 15th and 16th kings, the accession of Madanapāla cannot be placed earlier than 1103 A.D. Again, according to Mr. Banerji, Vijayasena conquered Varendra after the 8th regnal year of Madanapāla (*ibid.*, p. 284). As Mr. Banerji places the death of Ballālasena, who ruled for at least 11 years, at 1118 or 1119 A.D., Vijayasena must have ceased to reign before 1108 A.D. The date of Madanapāla's accession would thus fall some years before 1100 A.D., but, as we have just seen, this is irreconcilable with his other statements. Lastly, the dates proposed by Mr. Banerji for Dharmapāla and Devapāla are no longer tenable; for he has assigned 55 years to Nārāyaṇapāla and at least 3, 15, and 26 years respectively to Vigrahapāla I, Gopāla II and Vigrahapāla II. If we add to it the 24 years of Rājyapāla the sum total would be 123 years, which is considerably more than the interval between the dates proposed by him respectively for the death of Devapāla and the accession of Mahīpāla I, i.e., 865 A.D. and 973 A.D.

It is thus quite clear that none of the existing theories about the Pāla chronology is in accordance with all the known facts, and this necessitates a fresh study of the subject with a view to frame a more satisfactory hypothesis in regard to Pāla chronology.

The Sārnāth inscription of Mahīpāla I, dated in the year 1026 A.D.,[1] supplies us with a fixed point in the Pāla chronology. A consideration of the known reign-periods of the successors of Mahīpāla I, as given in the following list, seems to show that the king did not live long after that date, and that for all practical purposes that date may be looked upon as his last.

Nayapāla	..	15 years
Vigrahapāla III	..	13 years
Mahīpāla II	..	a (unknown)
Sūrapāla II	..	b ,,
Rāmapāla	..	42 years
Kumārapāla	..	4 ,, [2]
Gopāla III	..	c (unknown)
Madanapāla	..	19 years

[1] *Ind. Ant.*, Vol XIV, p. 140; *J.A.S.B.*, 1906, p. 445.

[2] It is quite clear from the wordings of the Kamauli grant of Vaidyadeva that Kumārapāla was the reigning king when that document was drawn up. The year 4, the date of the document, might therefore refer to the reign of Kumārapāla or that of Vaidyadeva in Kāmarūpa. In the first case Kumārapāla must have reigned for at least 4 years, in the second case, more than four; for Vaidyadeva was appointed ruler of Kāmarūpa by Kumārapāla sometime after the latter had ascended the throne.

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Now, as Madanapāla's inscriptions are found in Varendra, and Vijayasena is said to have conquered the province, Madanapāla must have preceded the latter. The date of Vijayasena can be ascertained, within narrow limits, by that of Nānyadeva whom he is said to have defeated. As Sylvain Lévi has shown, Nānyadeva became king in 1097 A.D., and the fact that Sadāśiva Deva of Nepal is styled Rājādhirāja Parameśvara in a Sanskrit manuscript dated in 1120 A.D. proves that this supremacy was over by that date. It is thus almost certain that Vijayasena must have defeated him in the first quarter of the 12th century A.D. and Madanapāla too must have been defeated not long afterwards.

Now, the sum total of the known reign-periods of the successors of Mahīpāla I is 93 years. To this must be added the unknown factors a,b,c, and d representing respectively the reign-periods of Mahīpālal II, Śūrapāla II, and Gopāla III, and the excess of the actual reign-periods of the rest over those known at present. The end of Madanapāla's reign will thus fall about 1119[1] + (a + b + c + d) A.D., if we count from the known date 1026 A.D., assuming it to be the last date of Mahīpāla I. As this takes us to the second quarter of the twelfth century A.D., it may be held that Mahīpāla I, died about 1026 A.D. and the same conclusion must be upheld even if it is proved than Madanapāla continued to rule for some time after the conquest of Varendra by Vijaysena, for, as it is, the unknown factors a,b,c,d, become almost impossibly short.

Now, the known reign-periods of the Pāla kings up to Mahīpāla I are shown in the following table :—

I.	Gopāla	
II.	Dharmapāla	32 years
III.	Devapāla	33 ,,
IV.	Vigrahapāla	3 ,,
V.	Nārāyaṇapāla	54 ,,
VI.	Rājyapāla	24 ,,
VII.	Gopāla II	
VIII.	Vigrahapāla II	
IX.	Mahīpāla I	48 ,,

The sum total of the reign-periods given above is 194 years. Again, Gopāla II must be credited with a long reign, for he is said, in the Bāngarh grant of Mahīpāla, to have ruled *Ciratarām*, which must in any case denote a period longer than that of his predecessor. As the latter, Rājyapāla, is known to have reigned for at least 24 years, we must assign a period of at least 30

[1] This should be increased by at least 13 years, for as the footnote 2, p. 5 shows, Vigrahapāla III whose reign-period has been assumed to be 13 years, probably ruled for at least 26 years.

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years to Gopāla II. Subtracting 194 + 30 from 1026, which we have shown to have been practically the last date of Mahīpāla I, we are in a position to affirm that Dharmapāla must have ascended the throne x years before 802 A.D., x denoting the reign-period of No. VIII, together with the number of years that the remaining kings must have ruled after their last known dates. This unknown factor can hardly be taken as less than a period of 20 years; indeed it would have to be considerably increased but for the fact that there are reasons to believe that Dharmapāla met Govinda III in about 808 A.D.[1]

This early date of Dharmapāla is corroborated by a verse in the Sañjana copper-plate of Amaghavarṣa[2] which informs us that the Rāṣṭrakūṭa king Dhruva defeated a king of Gauḍa between the Ganges and the Jamuna. This Gauḍa king can hardly be any other than Dharmapāla, for his predecessor Gopāla does not seem to have extended his conquests so far, and the political condition of the Gauḍa kingdom, just before the Pāla period, is hardly compatible with the view that any of its kings could extend his sphere of influence as far as Allahabad in the west. The argument that such an early date of Dharmapāla ill suits the supposition that he married the daughter of Paravala, who is known to have ruled in 761 A.D., is of no great weight, for the identity of this Paravala with the father-in-law of Dharmapāla must depend upon the date of the latter, and, besides, the published facsimile raises great doubts about the correctness of the reading of the date in the Pathārī Pillar inscription.

As a result of the foregoing discussion the following chronological table of the Pāla kings may be offered with some degree of certainty.

	Name of kings.	Known reign-period.	Approximate year of accession.
I.	Gopāla	....	770 A.D.
II.	Dharmapāla	32 years	780 ,,
III.	Devapāla	33 ,,	815 ,,

[1] An unpublished copper-plate in the possession of Prof. D. R. Bhandarkar, who was kind enough to allow me to make use of it, refers to the fact that while Govinda III proceeded towards the Himālayas in course of his conquest, Dharmapāla waited upon him. The same inscription also tells us that Govinda III defeated the Gurjara-Pratihāra king Nāgabhaṭa. It is reasonable to hold that both these events took place in one and the same expedition against the north. A comparison of the Waṇī and Rādhanpur grants of Govinda III shows that the expedition against the Gurjaras probably took place in the interval between the two, for the later grant is practically a repetition of the earlier one with the one important addition, viz. the reference to the Gurjara expedition. As both the grants are dated in the Śaka year 730, the date of the northern expedition of Govinda III may be placed at about 808 A.D.

[2] This is the unpublished copper-plate referred to in the last note.

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	Name of kings.	Known reign period.	Approximate year of accession.
IV.	Vigrahapāla I or Śūrapāla I	3 years	850 A.D.
V.	Nārāyaṇapāla	54 ,,	860 ,,
VI.	Rājyapāla	24 ,,	915 ,,
VII.	Gopāla II	(longer than 24 years)	940 ,,
VIII.	Vigrahapāla II	....	970 ,,
IX.	Mahīpāla I	48 years	978 ,,
X.	Nayapāla	15 ,,	1026 ,,
XI.	Vigrahapāla III	13 (or 26 ?)[1]	1042 ,,
XII.	Mahīpāla II	....	1070 ,,
XIII.	Śūrapāla II	....	1075 ,,
XIV.	Rāmapāla	42 years	1077 ,,
XV.	Kumārapāla	....	1120 ,,
XVI.	Gopāla III	....	1125 ,,
XVII.	Madanapāla	19 years	1130 ,,
[XVIII.	? Govindapāla[2]	....	1150 ,,]

[1] A manuscript of the *Pañcarakṣā* was copied in the twenty sixth year of Vigrahapāla. It is thus quite clear that one of the three kings bearing that name must have ruled for at least 26 years. I have assigned this period to Vigrahapāla III, for, otherwise the accession of Dharmapāla will have to be pushed still further back, a hypothesis which is by no means favoured by the fact, noted above, that he probably met Govinda III in 808 A.D.

[2] Nothing is definitely known about the successors of Madanapāla. A stone inscription found at Gayā and the colophons of several manuscripts refer to a king Govindapāla. The inscription is dated in the Vikrama Samvat 1232 and "*Śrī Govinda-pāla-deva-gata-rājye caturddaśa-samvatsare.*" Two of the colophons are dated "*Śrīmad-Govindapāla-devasya atīta-samvatsa 18*" and "*Śrīmad-Govindapāla-devānāṁ vinaṣṭa-rājye aṣṭa-triṁśat-samvatsare.*" I have attempted to prove in the accompanying paper on the Sena chronology that such expressions really mean that the years were counted from the cessation of the reign. If we accept this view we must hold, on the authority of the inscription of Govindapāladeva, that his reign was over 14 years before 1232 Vikrama Samvat. In other words, the king ceased to reign in 1162 or 1163 A.D. As I have placed the accession of Madanapāla in the year 1130 A.D., and the king is known to have reigned at least for 19 years, the end of his reign is brought quite close to the accession of Govindapāla; for it seems quite likely that Govindapāla succeeded Madanapāla not long after 1150 A.D., but was defeated, and his kingdom destroyed, by the Sena kings in 1162–3 A.D.

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2. The Chronology of the Sena Kings.

By R. C. Majumdar, M.A., Ph.D.

The chronology of the Sena kings has formed the subject of a keen and protracted discussion for a long time past. The earlier views on this very important question possess at present but an academic interest and have been summarised by Mr. N. Basu in J.A.S.B. Vol. LXV, part I, pp. 16 ff. The determination of the true epoch of the Lakṣmaṇasena era by Dr. Kielhorn[1] has placed the question on an altogether new basis, and the theories that are at present held on the subject may be broadly divided into two classes.

1. That the initial date of the era, 1118–19 A.D, is the date of the accession of Lakṣmaṇasena, the grandson of Vijayasena, the founder of the greatness of the dynasty.

2. That Lakṣmaṇasena ascended the throne long after the initial date of the era which commemorates either his birth or the accession of one of his predecessors.

The date of Lakṣmaṇasena is thus the crucial point, and before we proceed further we must examine the validity of the contention that the epoch of the Lakṣmaṇasena era must be the date of his accession.

Mr. R. D. Banerji, the staunchest and the most consistent supporter of this theory, states his case in the following words[2]: "None of the Indian eras, now known, seem to have been started by one king and adopted and renamed by any one of his successors." The evident implication, of course, is that the era which is associated with the name of Lakṣmaṇasena must have been started by him.

It is no use discussing the general principle laid down by Mr. Banerji, for the truth of the matter seems to be that the era was not *started by any king at all*. Keśavasena and Viśvarūpasena were the last kings of this dynasty, but their inscriptions are dated in their regnal years and no reference is made to any era. As a matter of fact not a single instance of the official use of this era has been discovered as yet and it seems to have been almost unknown in the home provinces of the Senas. These considerations are decidedly against the assumption that the era was ever formally started by any king of the Sena dynasty. It cannot thus be maintained, from general considerations alone, that the initial date of the era is the date of Lakṣmaṇasena's accession.

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1 *Ind. Ant.*, 1890, p. 1 ff. 2 *J.A.S.B.*, Vol, IX, p. 277.

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There are, however, two inscriptions of a king Aśoka-calladeva of Gayā which have been relied upon to prove that Lakṣmaṇasena ceased to rule before the year 51 of the era. It is, of course, evident that if this conclusion is true, a very strong case is made in favour of the view that the epoch of the era is synchronous with the initial date of Lakṣmaṇasena.

A brief summary of these inscriptions together with all the relevant points has been given by Mr Banerji in his paper on Lakṣmaṇasena (*op. cit.*). The important points about them are the dates which run as follows [1] :—

(i) *Śrīmal-Lakhvaṇasenasy = ātīta-rājye saṁ* 51.
(ii) *Śrīmal-Lakṣmaṇasena-deva-pādānām-atīta-rājye-saṁ* 74. *Vaiśākha vadi* 12 *Gurau.*

Dr. Kielhorn at first held, on the basis of the word *atīta* prefixed to the word *rājye*, that although the years were still counted from the commencement of the reign of Lakṣmaṇasena, that reign itself was a thing of the past.[2] This theory was ultimately abandoned by Dr. Kielhorn,[3] but has been re-stated by Mr. Banerji [4] and upheld by other scholars.[5]

Before we discuss the true significance of the expression *atīta-rājye* we shall point out the hopelessly irreconcilable results that ensue if the above view is accepted. Mr. Banerji says :—"We know from the Bodh-Gayā inscription of the 51st year of the Lakṣmaṇasena era, that Bodh-Gayā and its adjacent parts were in the possession of the Sena kings. This is indicated by the use of the era of Lakṣmaṇasena which could not have been used by a king of a distant country like Aśokacalla of Sapādalakṣa, if Gayā did not happen to be included in the territory of the Senas. The Gayā inscription of V.S. 1232, on the other hand, shows that once the country belonged to Govindapāla, but it had ceased to do so in the 14th year of his reign. So one can immediately infer that Gayā and its adjacent parts were wrested from Govindapāla by one of the Sena kings ..... The Bodh-Gayā inscription of *La-Saṁ* 74 proves that Gayā and the country around it continued in the possession of the Sena kings of Bengal."[6]

It must be remembered in the first place, that the expression denoting dates in the two Bodh-Gayā inscriptions is exactly similar to a series of expressions denoting dates with

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[1] *Ep. Ind.* XII, p. 27 ff. Mr. Banerji's text has 'rājya-saṁ' in both the records and the date as 72 in the last. (*Op. cit.*, p. 272). Evidently these are due to oversight.
[2] *Op. cit*, p, 2, note 3.
[3] *Synchronistic List for Northern India*, *Ep. Ind.* Vol. VIII.
[4] *Op. cit.*
[5] Mr. S. Kumar in *Ind. Ant.*, 1913, p. 185; Dr. Hoernle in a private letter to Mr. Banerji (*Bāṅglār Itihāsa*, p. 304).
[6] *Op. cit*, p. 280.

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reference to Govindapāla. This will be quite evident if we arrange below the dated portions of his inscriptions and the colophons of manuscripts referring to his reign.[1]

(i) *Śrīmad-Govindapāladevānāṁ gata-rājye Caturddaśa-samvatsare.*

(ii) *Śrīmad-Govindapāla-devasy = ātīta saṁvat* 18.

(iii) *Śrīmad-Govindapāla-devānāṁ vinaṣṭa-rājye Aṣṭa-triṁśat-samvatasre.*

No reasonable doubts can be entertained that all these phrases are but different expressions for denoting the same thing. Now the phrase used in No. i, is almost identical with that of the two Bodh-Gayā inscriptions referred to above, and, in any case, it is not permissible to attach different interpretations to them. But this is exactly what Mr. Banerji has done. He infers from the words *atīta rājye saṁvat* in the Bodh-Gayā inscriptions that Lakṣmaṇasena had ceased to reign, although Gayā was still under the Sena kings; but in spite of the expressions *gata-rājye* and *atīta saṁvat* used with reference to the 14th and the 18th years of Govindapāla, he holds that the latter reigned till the 38th year, although there was a cessation of his rule in those parts of the country in which the expresion *gata-rājye* or *atīta saṁvat* was used with reference to him! But let us examine the point a little more closely. As the above extract will show, Mr. Banerji holds:—

(i) That Govindapāla ruled over Gayā sometime between 1162 and 1175 A.D.

(ii) That the Bodh-Gayā inscriptions show that in the 51st year of the Lakṣmaṇasena era, Bodh-Gayā and its adjacent parts were in the possession of the Sena kings and that these territories continued in the possession of the Sena kings till the 74th year of that era.

As the years 51 and 74 of the Lakṣmaṇasena era would give us respectively the years 1160 and 1183 A.D., it seems to be somewhat difficult to reconcile the above two points.

Then there is another important question. If, as Mr. Banerji holds, Lakṣmaṇasena died before the year 51 of his era, his sons must have been on the throne between this date and the final conquest of the territory round Gayā by the Musulmans. How is it, then, that not only in the two Bodh-Gayā inscriptions of the years 51 and 74 A.D, but also in a newly discovered inscription[2] of the 83rd year of that era found in the neighbourhood, the name of Lakṣmaṇasena alone is invoked and not that of any of his successors? Again, what force is there in stating that Lakṣmaṇasena had ceased to reign, (assuming the interpretation of Mr. Banerji to be

[1] Quoted in Mr. Banerji's article, *op. cit*, pp. 278–9.

[2] *J.B.O.R.S.*, 1918, p. 273.

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correct), about forty years after that was an accomplished fact? On the analogy of other inscriptions dated, say in the Gupta or Kushan era, we should expect the name of the reigning king with the year of the era. We find for example the expressions "Huviṣkasya saṁ 33," [1] and "Śrī-Kumāraguptasya .... saṁvatsare 96." [2] In both these cases the name of the reigning king is mentioned along with the years of the era founded by his predecessor, and this seems to have been the standard practice in ancient India.

These considerations raise grave doubts about the correctness of the deduction that the epoch of the Lakṣmaṇasena era is the year of the accession of that monarch. There are, however, positive evidences which seem to demonstrate the impossibility of this view.

The Deopārā inscription of Vijayasena [3] proves that he was master of Varendra. Now the Manhali grant of Madanapāla [4] shows that he occupied Varendra till at least the eighth year of his reign, for he made some land-grants in the Puṇḍravardhana bhukti in that year. It would thus follow that Vijayasena must have ceased to reign after the eighth year of Madanapāla, a conclusion which has been accepted by Mr. Banerji in his latest writing on the subject.[5] We can arrive at the upper limit of the date of Madanapāla by counting the reign-periods of his predecessors as far as Mahīpala I, one of whose known dates is 1026 A.D. This will be quite intelligible from the following table :—

Mahīpāla I	..	1026 A.D.
Nayapāla	..	15 years
Vigrahapāla III	..	13 ,,
Mahīpāla II	..	a ,,
Śūrapāla II	..	b ,,
Rāmapāla	..	42 years
Kumārapāla	..	4 ,,
Gopāla III	..	c ,,
Madanapāla	..	..

It will be evident from the above table that Madanapāla ascended the throne in 1100 + (a + b + c + d) A.D., these letters representing respectively the unknown reign periods of Mahīpāla II, Sūrapāla II, and Gopāla III, and the excess of the actual reign-periods of the rest over those known at present. The initial date of Madanapāla's reign must therefore fall some years, probably a good many years, after 1100 A.D.

As we have seen above, Vijayasena must have ceased to reign after the eighth year of Madanapāla. His successor

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[1] Lüder's *List*, No. 41.
[2] Fleet's *Gupta Inscriptions*, *No. 10.*
[3] *Ep. Ind.* Vol. I, p. 305.
[4] *J.A.S.B*, 1900, p. 66.
[5] *Bāṅglār Itihāsa*, p. 284

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Ballālasena could not therefore have come to the throne till some years after 1108 A.D. As the Naihati grant[1] of Ballālasena is dated in the 11th year of his reign, he must have ruled for at least 11 years, and his son and successor Lakṣmaṇasena could not therefore begin to reign till some years after 1119 A.D. It is thus obviously impossible that the epoch of the Lakṣmaṇasena era, viz. 1118–1119 A.D. is the year of the accession of that monarch.

So far we have definitely established two important points, viz. :—

1. Neither the epoch of the Lakṣmaṇasena era nor the wordings used in connection with it necessarily place the accession of that monarch in 1118–19 A.D.

2. There are positive evidences which show that Lakṣmaṇasena did not come to the throne till some years, possibly a good many years, after 1118–19 A.D.

Having settled these preliminary points we are now in a position to take into consideration such other evidences as are expected to throw light on the problem.

I. There are still extant two learned works composed by Ballālasena, viz. Dānasāgara and Adbhutasāgara. Some manuscripts of these two works contain verses denoting the time of their composition.[2] Thus we have in some manuscripts of Adbhutasāgara :—

(*a*) *Bhuja-vasu-daśa-1081-mita-śake śrīmad-Ballālasena-rājy-ādau*[3].

(*b*) *Śāke Kha-nava-kh-endv=abde ārebhe Abdhutasāgaram* |
Gauḍendra-Kunjar-ālāna-stambha-vāhur=mahīpatiḥ ‖.[4]

Again we have in some manuscripts of Dānasāgara :—

(*c*) *Nikhila-cakra-tilaka-śrīmad-Ballālasenena-pūrṇe* |
Śaśi-nava-daśa-mite Śakavarṣe Dānasāgaro racitaḥ.[5] ‖

The first of these extracts places the accession of king Ballālasena in or shortly before 1159 A.D.[6], while the second and the third refer the composition of two of his works respect-

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[1] *Ep. Ind.*, Vol. XIV, p. 156.

[2] Cf. the description of these works given by Mr. Banerji, *op.cit.*, pp. 274 ff.

[3] This passage is not noticed by Mr. Banerji, although it was pointed out as early as 1906 by Mr. M. Chakravarty. (J.A.S.B. 1906, p. 17, note 1).

[4] Bhandarkar's *Report on the search for Sanskrit Manuscripts* during 1887-88 and 1890-91, p. LXXXV.

[5] *J.A S.B.* 1896, Part I, p. 23. *Gauḍarājamātā*, p. 61 footnote.

[6] Mr Manomohan Chakravarty op. cit. and following him Mr. Ramaprasad Chanda (*Gauḍa-rāja-mālā*, p. 62) have taken the word *ādau* to mean the 'first year,' and thus placed the accession of Ballālasena in the year 1159 A.D. on the strength of this verse. It appears to me, however, that the word might as well mean the 'first part' and thus the accession of Ballālasena would be placed in or sometime before that date.

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ively to 1168 and 1169 A.D. These three verses are therefore perfectly consistent in themselves.[1]

Mr. R. D. Banerji, however, ignores their value mainly on the two following grounds:—

(i) That the extracts (b) and (c) are not to be found in all the available manuscripts of these two works, and that they are therefore to be looked upon as interpolations.

(ii) Even supposing that they are genuine, evidence based on very modern copies of manuscripts can hardly be put forward against the testimony of contemporary epigraphical records.

As regards the first point, it is no doubt true that in the absence of these verses from some of the manuscripts, conclusions based upon them cannot be regarded as final unless corroborated by other evidence, but it is certainly going too far to say that they are to be looked upon as interpolations merely on that account.[2]

As regards the second point, the principle advanced is quite all right, but its application in the particular instance does not seem to be correct; for, as we have seen above, there is nothing in the contemporary epigraphic records that is really in conflict with the verses quoted above.

II. The statement of the Moslem historian Minhāj that Rai Lakhmaniya was defeated by Muhammad, son of Bakhtiyar, within a few years of 1200 A.D. (the dates proposed by Raverty, Cunningham and Blochmann being respectively 1194, 1195, and 1198–9 A.D.) corroborates and is corroborated by the testimony of the verses quoted above; for the identity of Lakhmaniya and Lakṣmaṇasena is evident and has been recognised long ago, and with a date for Ballālasena in about 1160–1170 A.D., the reign of Lakṣmaṇasena naturally falls towards the end of the twelfth century A.D

[1] The doubts raised on this point by Mr. Nagendranath Vasu seem to be due to a misunderstanding. We learn from some verses in *Adbhutasāgara* which follow the extract (*b*), that Ballālasena died before he could complete the book, and that it was finished by his son Lakṣmaṇasena. Mr. Vasu argues that if Ballālasena died in 1090 Śaka without being able to complete *Adbhutsāgara*, how is it possible that he himself composed *Dānasāgara* in 1091 Śaka as testified to by the extract (*c*) above. The fact, however, is that the passage in *Adbhutasāgara* does by no means indicate that Ballālasena died in 1090 Śaka. It simply tells us that the book was begun in that year and was left incomplete when its author died. It may be readily supposed that the royal author commenced his work in 1090 Śaka and was engaged over it for a few years when he died. In the meantime another work, *Dānasāgara*, which was probably begun earlier, was brought to completion in the year 1091 Śaka. The statements made in *Adbhutasāgara* and *Dānasāgara* are not therefore inconsistent with each other.

[2] Mr. Banerji unduly minimises the significance of the fact that three isolated passages in two different works corroborate one an another. The arguments advanced by Mr. Chanda (*Gauḍa-rāja-mālā*, p. 62) to prove the genuineness of these passages are very reasonable and have not, so far as I know, been met by Mr. Banerji.

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III. The date of Aśokacalla is also in full accord with the above view if we correctly interpret the data we possess about him. Now one of his inscriptions is dated in the year 1813 of the Nirvāṇa era. The late Dr. Fleet has shown that although different views were current about the date of the Nirvāṇa in Ceylon, all these were superseded, towards the end of the twelfth century A.D. or a little earlier, by the assumption that the event was to be placed at 544–543 B.C.[1] Mr. Taw Sein Ko says that this era was known to the Burmese long before the 12th century A.D.[2] About the particular inscription of Aśokacalladeva and its date in the Nirvāṇa era, Fleet remarked :—"Treating this date as a date in the reckoning of B.C. 544, and taking Kārttika as the Pūrṇimānta month, ending with the full moon, which is what we should expect, I find that the given details are correct for Wednesday, 1 October, A.D. 1270."

With this date of Aśokacalla in view, the meaning of the dated portions of his other two inscriptions becomes self-evident. These are : (i) Lakhvaṇasenasy = ātīta-rājye saṁ 51. (ii) Lakṣmaṇasena-deva-pādānām = atīta-rājye saṁ 74 Vaiśākha vadi 12 Gurau.

Now if there are reasons to believe that Aśokacalla flourished about 1270 A.D., naturally the dates in the above two inscriptions would be taken as counted from the cessation of the reign of Lakṣmaṇasena, that event itself being placed towards the end of the twelfth century A.D. Taking Blochman's date for this event, the second inscription, which alone admits of verification, regularly corresponds to 1271 A.D., May 7, Thursday. (With dates proposed by Cunningham and Raverty it would correspond respectively to 1267 A.D., April 21 Thursday, and 1268 A.D., May 10 Thursday[3]).

No reasonable objections can be urged against this view. On the analogy of such expressions as *Vijaya-rājye saṁ* 4 which means '4 years having elapsed (or 4th year being current), counted from the commencement of Vijayarājya,' *atīta-rājye saṁ* 51 may easily be taken to mean that 50 or 51 years had elapsed since the *atītarājya* or the cessation of reign. The sense is made quite clear by the corresponding expressions "*gata-rājye*," "*vinaṣṭa-rājye*, etc., which occur in the place of *atīta samvat* in some of the inscriptions of Govindapāladeva. There can be no reasonable doubt that these expressions easily lend themselves to the interpretation that the reckoning was made from the end of a king's reign or the destruction of a kingdom.

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[1] *J.R.A.S.*, 1909, p. 323 ff. Also cf. *J.R.A.S.* 1910, pp. 474 ff, 857 ff; *J.R.A.S.* 1911, p. 216 ff. [2] *J.R.A.S*, 1911, p. 212.

[3] According to the calculations of Swamikannu Pillai with which Prof. D. R. Bhandarkar was kind enough to supply me.

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The possibility of such a reckoning is indisputably proved by the inscriptions of Govindapāladeva, notably the two following instances :—

(i) *Govindapāla-devānām vinaṣṭa-rājye Aṣṭa-triṁśat-saṁvatsare.*

(ii) *Govindapāla-devānām saṁ 39.*

Even according to the interpretation of Mr. Banerji, the kingdom of Govindapāla was destroyed in the 38th year. The second instance therefore shows that reckoning was still made with reference to his reign. Mr. Banerji has himself noticed this point and his remarks are worth quoting. "The reference," says he, "in a record to the reign of a king who had ceased to reign over those parts is curious. Probably Buddhists did not want to refer to the reign of a king who, though king *de facto*, was not a Buddhist in faith. When the king had finally ceased to reign, and all Indian kingdoms had been indiscriminately destroyed in Bihar and Bengal, the scribe had only to indicate the date of the dethroned prince with abridged titles and adjectives denoting that his reign was already a thing of the past."[1]

And this is indeed the key to the true explanation. It is probable that when the Pāla kingdom was finally destroyed by the Senas, the Buddhists, unwilling to refer to the reign of a non-Buddhist king, continued to count their dates with reference to the destruction of the last Pāla king, viz. Govindapāladeva. Again, when the Indian kingdoms had been indiscriminately destroyed in Bengal and Bihār by the Islamic invaders, the scribe, unwilling to refer to the *pravardhamāna-vijaya-rājya* of the Moslem conquerors, counted the dates with reference to the destruction of the last independent native kingdom.

Reference may be made in this connection to the fact that even less than two hundred years ago, there were current in Bengal, eras, known as Balāli San or Parganāti San.[2] The colophon of a manuscript gives the date as 1176 Banglā San, 570 Balāli San and 1692 Śaka. The epoch of this era would thus fall in 1199 A.D. All the documents, which are dated in the Parganāti San along with a known era, show that its initial year corresponds to 1202–3 A.D., there being only one exception according to which the initial year would correspond to 1203–4 A.D.

I do not, of course, go so far as to assert positively that

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[1] *Op. cit.*, p. 280.

[2] For a detailed account of this era cf. Mr. J. Roy's 'Dhākār Itihāsa' Vol. II, p. 393 ff. and Mr. Bhaṭṭaśāli's paper in *Ind. Ant.* 1912, p. 169 ff. Mr Bhaṭṭaśāli seems to have been wrong in reading the name of the era as '*parganātīt*' rather than '*parganāti*.

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the years of the Gayā inscriptions are to be counted with reference to one of these eras; but the fact that their epochs fall so closely to the end of Lakṣmaṇasena's reign, and the names given them, viz. *Ballāli*, evidently a contracted form of Ballāli, i.e. pertaining to Ballāl (Sen), seem to me to lend strength to the conclusion, we have independently arrived at above, that there was a practice, in different parts of the country, of counting dates with reference to the end of the last independent Hindu dynasty.

Thus three independent lines of evidence, viz. the dates given in Dānasāgara and Adbhutasāgara, the account of the Muhammadan historian Minhāj and the dated inscriptions of Aśokacalladeva, all lead to the conclusion that Lakṣmaṇasena flourished towards the end of the twelfth century A.D. This view again is in full agreement with what we know about the relations of the Pāla and the Sena kings. For, as we have seen above, Madanapāla could not possibly have flourished earlier than the first quarter of the twelfth century A.D., and he was in possession of Varendra which was afterwards conquered by Vijayasena.[1]

The date given in Dānasāgara and Adbhutasāgara being thus corroborated by external evidence, we may provisionally accept the statement in Adbhutasāgara that Ballālasena ascended the throne in or shortly before 1159 A.D. As one of the inscriptions of Vijayasena is dated in the 32nd year of his reign[2] he must be held to have enjoyed a long reign. Thus his accession is placed quite close to the year 1119 A.D., the epoch of the so-called Lakṣmaṇasena era. This naturally gives rise to a strong presumption that the era commemorates the accession of that monarch. The fact seems to be that with the destruction of the Hindu monarchy the reckoning was made from the end of Lakṣmaṇasena's reign, and it may be held, on the analogy of the inscriptions of Govindapāladeva, that the expressions used in connection with this reckoning would be either such full titles as *Lakṣmaṇasenasy = ātīta-rājye* or simply *Lakṣmaṇīya saṁ* or even *saṁvat*.[3] It is easy to infer that the second expression came to be contracted as *La Saṁ*. The earlier *La Saṁ* therefore seems to have commemorated the end of Hindu monarchy. Later on, however, the people probably came to the right conclusion, that the best way of commemorating the rule of the Sena kings is not

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1 That the contemporaneity of Vijayasena and Nānyadeva leads to the same conclusion has been shown in the accompanying Paper on Pāla Chronology.

2 Ep. Ind., Vol XV, p. 278.

3 For the era associated with Govindapāla is variously known as
(1) Govindapāla-devasy-ātita-samvat,
(2) Govindapāliya-Samvat.
(3) Govindapāla-devānām-saṁ.

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to reckon the date from their destruction but from the foundation of their greatness. An artificial era was therefore set in with the date of the accession of Vijayasena, the founder of the greatness of the family, as the initial year. It may be that there was some difference of opinion on this point, some looking upon the date of accession of Hemantasena as the true starting point of the era. This might explain the different mode of counting the era in Mithila, with an initial point in about 1106–7 A.D. It appears that this era was confounded with the true *La Saṁ* and both came to be indifferently called by this name till the earlier one was altogether superseded by the later.

For the present, however, all this is mere conjecture, and it is to be distinctly understood that the main proposition advanced in this paper about the date of Lakṣmaṇasena, rests absolutely independent of this or any other similar hypothesis to explain the origin of the era of 1118–9 A.D., or its association with the name of Lakṣmaṇasena. For the matter of that, other explanations are equally likely, and may be urged with equal cogency. One might, for example, hold that the era commemorates the conquest of Mithilā by Vijayasena and was at first current in that locality, till it was confounded with the other current in Gayā and its neighbourhood and came to be associated with the name of Lakṣmaṇasena. It is useless to speculate on these hypothetical explanations, but they show the possibility of the association of the name of Lakṣmaṇasena with an era which had at first nothing to do with him or his reign.

On the basis of the foregoing considerations the chronology of the Sena kings may be laid down as follows :—

Name of the King	Name of the Queen	Approximate year of accession.
Sāmantasena	..	..
Hemantasena	Yaśodevī	1106 A.D.
Vijayasena	Vilāsadevī	1118–9 A.D.[1]
Ballālasena	Rāmadevī	1159 A.D.
Lakṣmaṇasena	Tāḍādevī	1175 A.D.
Viśvarūpasena	..	1200 A.D.
Keśavasena	..	1225 A.D.

[1] My friend Mr. N. K. Bhattasali suggests that the date of the newly discovered inscription of Vijaysena referred to on p. 9 above is not 32, as read by Mr. Banerji but 61. In that case the accession of Vijaysena has to be placed before 1118–19 A.D. and the theory that the era of 1118–19 A.D. commemorates his accession must be abandoned. It is needless to point out that Mr. Banerji's theory that Lakṣmaṇasena ascended the throne in 1118–19 A.D. is quite incompatible with this new reading of the date.

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3. NUMISMATIC SUPPLEMENT No. XXXV.

Note.—The numeration of the articles below is continued from p. 249 of the "Journal and Proceeding" for 1921.

212. A Bombay Half-Rupee of Charles II.

Metal	..	Silver
Mint	..	Bombay.
Size	..	·8 of an inch.
Weight	..	90 grains.
Date	..	?
Provenance	..	Munich, Bavaria.

Obverse—

In centre PAX DEO in two lines, within a beaded circle, around it (MONETA) BOMBAIEN(SIS) surrounded by a beaded circle between two lined circles.

Reverse—

A shield of Arms—Three ships, etc., between two wreaths.

A similar coin without date, but a rupee probably, the property of the British Museum and published by Dr. Thurston is attributed to the reign of Charles II. (Plate XVIII 5 of the Madras Museum catalogue). Also compare Mr. Atkins' Rupee No. 11 (figured) and a half-rupee No. 12, both undated (Coins and Tokens, etc., of the British Empire, London, 1889, page 137.)

Mr. Atkins in his work writes:—"The first commercial intercourse of the English with India was a private adventure of three ships, which were fitted out in 1591.... The earliest coins for the East Indies were either struck at our own mint by our monarchs or coined by their authority.... During the reign of Charles II the Company began by authority from the Crown to strike coins for their factory at Bombay, all of which

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bore either the name or some reference to the Sovereign..... The first money coined in the East Indies was at Bombay in the years 1671, when the Court of Directors gave instructions to their servants to establish a mint, and a few years later this measure was sanctioned by the Crown. A clause in the charter granted by Charles II, dated October 5th, 1677, empowered the Company "to stamp money at Bombay..."

This half-rupee also bears no date or the name of the sovereign but appears to have been issued during the reign of Charles II.

I have not been able to refer to the works of Ruding and Bruce, nor to Mr. Thomas's article in the Indian Antiquary, Bombay, 1882.

Bombay,
31st January, 1919. } C. E. KOTWÁLL.

NOTE.—A rupee of this description was in the White King collection, No. 988 of Schulman's Sale Catalogue.—(*Editor.*)

213. THE OFFICIAL SEAL OF PRINCE A'ẓam Shāh.

Prince A'ẓam Shāh was the eldest son of Aurangzeb. At the time of his father's death he was Governor of Gujarāt and part of Central India. He disputed the succession with his brothers, prince Mu'aẓẓam (subsequently Shāh 'Ālam Bahādur) and prince Kām Bakhsh, and struck coins in his own name in the years 1118 and 1119 A H., all of the first regnal year. These are known in gold and silver of eight mints and are all rare. A'ẓam Shāh was defeated and slain at the battle of Jājau near Āgra in the year 1119 A.H.

I now illustrate a brass official seal of A'ẓam Shāh bearing the name of his Wazīr Zain Khān which was dug up in the Old Fort, Delhi, during the winter of 1914-15. The seal itself is in the Delhi Museum. It was sent to me for identification and the Deputy Commissioner of Delhi kindly permitted me to publish it.

R. B. WHITEHEAD, I.C.S.

18th May, 1920.

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214. Fīroz Shāh Ẓafar, Ibn Fīroz Shāh.

The late Mr. Rodgers, puzzled as other numismatists have been, was the first to throw doubts on the ready assumption adopted by Edward Thomas that Ẓafar, the second son of Fīroz Shāh, was associated by his father in the kingship immediately after the death of Fatḥ Khān, the heir apparent, in 763 H. Mr. Rodgers, however, does not controvert the statement of such association, but suggests that another prince, named Fīroz Shāh Ẓafar, succeeded to the throne of Delhi for a portion of the year 791 during the troublous period which ensued after the death of Fīroz Shāh in the beginning of 790. His theory was based on the obvious fact that all the dated coins of Ẓafar belong to the single year 791, a date by which, according to Thomas, Ẓafar, the second son of Fīroz, "must obviously have been in his grave."

Now Thomas states accurately enough that whereas the coins of Fatḥ Khan "show signs of provincial treatment, the "coins of Ẓafar coincide closely in their general aspect with "the ordinary money of the reigning monarch, and in so far "fully bear out the declaration on their surfaces of a Delhi "mintage." The coins of Ẓafar were undoubtedly struck at Delhi, while those of Fatḥ Khān may be attributed with almost equal certainty to the eastern viceroyalty, the *Iqlīm-ush-sharq*, which appears on the marginal legend of his gold pieces, and which afterwards became the independent kingdom of the Sharqi Sulṭāns of Jaunpūr. Fatḥ Khān, the favoured heir, the "beloved of the east and the west," exercised kingship as the deputy of his father in the eastern portion of the Empire, but there is nothing to show that Ẓafar, who appears to have succeeded for a time to the viceregal appointment of Jaunpūr, attained equal honours to those of his elder brother. Possibly the reason was that Ẓafar held the Eastern Provinces for a very short time, as we hear of him afterwards as the warden of the western marches.

The inference is that Ẓafar after leaving Jaunpūr settled down to the administration of the Punjab and Multān for the rest of the long reign of Fīroz. No actual record of his death is traceable. It may exist in some history of which I am unaware; but in the absence of definite proof there is no reason to reject the positive testimony of coins which show that Ẓafar survived his father.

The assumption that Ẓafar followed Fatḥ Khān as joint ruler with his father apparently rests on the fact that in 789 the Shāhzāda Muḥammad, the third son of Fīroz, unquestionably was made deputy to the Sulṭan, owing to the advanced age and failing strength of that monarch. Then the circumstances were entirely different. Fīroz was old, feeble and his mind had become infirm. The ascendancy of the Wazir was

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resented by the "slaves of Fīroz Shāh," and the dynasty needed open support. When Fīroz died, Muḥammad was compelled to resign his share in the kingship, and to yield to the law of primogeniture. Tughlaq, the son of Fatḥ Khān, was the obvious successor, and when he proved a failure and was removed in the manner sanctioned by precedent, the nobles, according to Thomas, "put forward Abūbakr Shāh, the son of Ẓafar Khān, as a claimant for the throne."

This account, it is submitted, is incomplete. When Tughlaq succeeded, it was obviously to the advantage of Ẓafar to remain in the background. When Tughlaq was deposed, the right of succession would devolve in the natural sequence on Ẓafar; but if Ẓafar was away from Delhi, if he was still, for the sake of argument, in his western viceroyalty, the obvious course was to take his son as his representative. By putting forward Abūbakr, the claims of Ẓafar could be maintained against Muḥammad, who in his strongholds of the north thought of nothing but the recovery of the sovereignty which he had exercised for a year or more.

According to the coins, Tughlaq reigned from the death of Fīroz in 790 till his death in Safar 791, Ẓafar reigned in 791, and Abūbakr reigned in 791 and 792. The vast majority of the coins of Abūbakr bear the date 792 and those of 791 are rare. Consequently it is reasonable enough to suppose that his rule comprised but a short period of 791. In Ramẓān 792 Muḥammad reoccupied the throne, a fact which accounts for the existence of a few coins bearing his name and that date, although the resistance of Abūbakr was not finally overcome till Muḥarram 793.

The conclusion is irresistible. Ẓafar, under the style of Fīroz Shāh Ẓafar, succeeded Tughlaq II, but survived his succession only a few months, and was followed by his son Abūbakr. The testimony of the coinage cannot be ignored. We have a Sulṭān named either Fīroz Shāh Ẓafar bin Fīroz Shāh or else Fīroz Shāh Ẓafar plain and simple, whose only date is 791, and we cannot on the strength of an analogy prove that these coins were struck jointly by Fīroz and his son, especially as any such contention involves, in the case of the more common coins, an assumption that they were issued when both Fīroz and Ẓafar were dead and another Sulṭān ruled in Delhi.

It may fairly be argued that the adoption of the title of Fīroz Shāh in conjunction with Ẓafar was done to strengthen the claim of that prince to the throne in the eyes of the people. Fīroz Shāh reigned in peace and popularity for nearly forty years and his prestige was immense. The third son, Muḥammad, styles himself invariably Muḥammad Shāh Fīroz Shāh and not Muḥammad Shāh bin Fīroz Shāh, and the point though small is not insignificant.

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It is no light matter to interfere with the accepted chain of history, but when acceptance involves the brushing aside of palpable dates as inconveniences, one can only feel surprise at the acquiescence displayed in the admittedly theoretical explanation given by one who, though the greatest expert of his day, has shown himself, in many points of equal importance, liable to the common failing of mankind.

H. NEVILL.

215. THE CURRENCY OF THE PATHAN SULTANS.

One of the strangest facts connected with the study of early Muhammadan numismatics in India is the extent of our ignorance as to the designation and value of coins belonging to well-known and characteristic types. Much effort was devoted by Edward Thomas to the origin of particular weights, but on the few occasions on which he attempts to give a definite value to a billon or copper coin, he displays the greatest diffidence. We have come to know coins by their types and weights, but few attempts have been made to give a denominational value to a particular type.

The subject is one of absorbing interest to the numismatist, and though the matter demands a great expenditure of labour in the way of research and the elaboration of detail, it is high time that a start should be made in removing a reproach to an exact science, and it is hoped that active numismatists will lend their aid in the quest after precision. In this paper it is not proposed to touch on the relation of gold to silver, but merely to initiate an attempt to show that certain well-known coins may be described with greater accuracy than "the large billon of Fīrōz" or "the small copper of Mubārak."

In making this start, it seems desirable to adopt certain postulates. These are not proved, and are possibly incorrect; but until they are disproved, it is better to base theory on assumptions and if subsequent adjustment is found necessary, to apply that adjustment to the subject as a whole.

It is stated by Thomas and endorsed by Mr. H. Nelson Wright that the *tanka* weighs 175 grains or 100 *ratis*. The weight of the *rati* therefore is 1·75 grains, and if this is accepted as accurate, we have to make very considerable allowances for the wear and tear of ages. It is of course possible that the real weight of the *rati* was under-estimated at first, and force is lent to this suggestion by the unquestionable fact that while perfect specimens of the *tanka* subsequent to the reign of Fīrōz Shāh have actually a weight of 175 grains, no silver *tanka* struck before the days of Muhammad bin Tughlaq has a higher recorded weight than 170·2 grains and the average weight of all the *tankas* recorded by Thomas up to the days of Fīrōz Shāh is no higher than 166 grains.

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The second postulate is that the value of copper in relation to silver stood at 64 to one up to the days of the Mughal conquest. Much ingenuity is displayed by Thomas in proving this contention, and it is indubitably the case that throughout the period the quarternary system prevails. It is perfectly clear that the *tanka* contained 64 *jaitils*; but at the same time we have distinct evidence of the introduction at certain periods of a decimal system.

Further, we have to be cautious. Too much stress must not be laid on the accuracy of the weighing machines employed in the mints, or on the honesty of the officials. A defect of a grain or two would probably pass without notice, and in spite of the notorious skill of the craftsmen in slicing the exact amount of metal off a bar, it is not difficult to imagine that while an unduly heavy piece would be clipped, a slight defect in weight would be disregarded. Allowance for such laxity is most necessary in the case of billon. The general existence of a billon coinage enabled the sovereign to manipulate the coinage to suit his purse with very slight chances of detection, and even if the coinage were not debased deliberately, it was as easy for the mint master to secure a handsome profit by a slight reduction in the proportion of silver.

Consequently we have to bear in mind that the ideal proportion and weight do not necessarily coincide with the real. Allowances must be made readily for divergence from the standard not only as intentional, but also because it by no means follows that the admixture of copper and silver in the correct proportion will produce a mass perfectly and molecularly homogeneous and uniform. The methods adopted in the formation of the alloy were crude, and it cannot be assumed that the bars from which the coins were cut contained silver and copper in the same proportion throughout. This is a matter to which insufficient attention has been paid in the past, and I am indebted to the courtesy of the Master of His Majesty's Mint at Calcutta for an authoritative opinion on the subject. It is clear that if so appreciable a variation occurs in an alloy containing the insignificant proportion of copper as that used for the manufacture of current silver coin, the variation in cases where copper largely predominates in bulk must be very wide. He writes:—

"As regards the question of homogeneity of silver-copper "alloys when cast into bars, there is no doubt whatever "that such bars are not uniform in fineness throughout their "length. This is not only a matter of common knowledge to "those who have to deal with such alloys, but is a matter "which is taken into account in modern Mints in the manu- "facture of silver coins; when casting bars of standard "silver it is always found that the tops and the bottoms have "different finenesses and an appreciable remedy for fineness of

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"the coins made from the bars is allowed in consequence. It "has been found, however, that there is one exception, namely, "the silver-copper alloy containing about 71 to 72 per cent. of "silver (theoretically 71·89 per cent.); this silver-copper alloy "when melted and cast into a bar is homogeneous throughout, "even when the bar is allowed to cool rapidly."

This is a most valuable piece of information and is of the greatest interest in the study of Pathān billon. It accounts in large measure for the very unsatisfactory results attained by tests in the past and forces us to reconsider decisions reached by Thomas and apparently accepted without demur by his successors

The expressed opinion of Thomas that billon coins had their value determined by sight and touch involves too large a demand on the imagination. It is incredible that coins having the same weight and bearing identical legends should have been intended to pass current at different values. The appearance of the newly struck billon does not seem to have been taken into account. Appearances at the present day are most deceptive. A coin may seem to be pure copper, but after treatment by fire or by acid at the hands of the *sonar* the same coin will seemingly consist mainly of silver. Almost any billon can be cleaned so as to present a silvery appearance, and we have to think of the coins as they must have looked six hundred or more years ago, and not in their present guise as they appear after centuries of burial and exposure to chemical action.

On this point the Master of H.M. Mint adds the following comment:—

"The question of the composition and the methods of "identification of ancient coins to which you refer as dealt "with by Edward Thomas is one which is quite outside the "work of the Mint. The suggestion that coins of the same "size and design had widely different values which were deter-"mined by the public according to the appearance and touch "appears absurd from the modern point of view, since it is "always considered of the first importance in designing and "manufacturing coins to arrange that different denominations "shall be as distinctive as possible from each other, as regards "size and design, and different shapes are sometimes adopted "to give further distinctiveness."

This was as true five hundred years ago as it is now. The various types obviously had different values, for otherwise all coins might have been of the same size and design. One has only to examine the great variety of the coinage in the days of Fīrōz and others, such as Tughlaq II in particular, to feel assured that the suggestion put forward by Thomas is altogether untenable.

Practically all the information we possess as to the frac-

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tional portions of the rupee expressed in billon and copper is derived either from the labelled pieces of Muḥammad bin Tughlaq in the shape of his forced currency or else from the account given by Shams-i-Sirāj 'Afīf, the biographer of Fīrōz Shāh. It is unnecessary to refer here to the half-*tankas* and the extremely rare fractions of the *tanka* in pure silver which have come to light. These obviously bear a direct relation to the *tanka* by their weight, and from the numbers which have been found it is manifest that small change was restricted mainly to pieces of billon and copper.

With a *tanka* of 175 grains we should expect a copper *jaitil* of the same weight. No such coin is to be found, however, till we reach the heavy coppers of Fīrōz Shāh and his successors. It is unsafe perhaps to assert that it never existed in earlier days, for even the well-worked field of the "Pathan" kings of Delhi still continues to provide the most unexpected discoveries. The obvious fact, however, is that no copper *jaitil* of full weight is known earlier than the time of Fīrōz Shāh, and the only inference is that, if this coin existed at all, it must have been in billon. Here again we encounter a difficulty, for the *jaitil* as $\frac{1}{64}$ of a *tanka* would contain no more than 2·234375 grains of pure silver, and consequently the silver element would be hardly perceptible. Therefore either the *jaitil* was a mere money of account or else a copper coin current as a *jaitil* had a conventional and fictitious weight. The *jaitil* of Muḥammad bin Tughlaq (Thomas No. 207) is represented by a single specimen weighing 74 grains. This coin is supposed, owing to the fact that it bears its designation on its surface, to have formed part of the system of forced currency, though it is difficult to understand why the *jaitil* should have been represented as a substantial coin, when the *dogani* was less than half its weight, amounting to a paltry 16 *ratis*.

With the heavy copper of Firōz Shāh, a coin of great rarity, we get a coin of at least 140 grains. Now a 140 grain or 80-*rati* copper represents $\frac{1}{64}$ of the silver *'adalī* of 140 grains, but does not bear any obvious relations to the 175 grain *tanka*. It would be very convenient to assume a *jaitil* of this weight, for this would not only enable us to place as *jaitils* the coppers of Muḥammad bin Fīrōz, Maḥmūd bin Muḥammad and Sikandar (Nos. 266, 274 and 278), but also to find half-*jaitils* in the well-known coppers of Ghiaṣu-d-dīn Balban, Mu'izzu-d-dīn Kaiqubād, Jalālu-d-dīn Fīrōz, 'Alāu-d-dīn Muḥammad and others, which clearly weigh 70 grains or 40 *ratis* in their perfect state. The objection to this is that in the coppers of Abūbakr (Nos. 258 and 259) we have coins which in some instances weigh as much as 165 grains, while the coppers of Mubārak (No. 288) actually run to 172 grains and their halves bear out the same conclusion.

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Probably the easiest solution of the problem, though not wholly satisfactory, is to assume that in theory the 140-grain coppers were actually *jaitils* and the 70-grain coppers were half-*jaitils*, and that although in many cases the weight is over 140 grains, yet the amount of copper which the ideal coin should have possessed was not present in practice except in a few instances.

On this assumption we have a clear example of the *jaitil* and its subdivisions in the coins of Fīrōz Shāh. The large copper was what is now termed a pice or $\frac{1}{64}$ of the rupee, the common 70-grain copper was a half *jaitil* or half-pice (No. 283) and the 36-grain copper (No. 234) was a *fals* or quarter-*jaitil*. Unfortunately the name of the half-*jaitil* is unknown, but on this basis we can account for the great majority of the purely copper pieces subsequent to the reign of Altamsh, the intricacies of whose coinage require special study.

If the solution of the problem presents difficulties in the case of copper, the complications arising from the mixture of copper with silver are far more perplexing. It is clear that all fractions of the *tanka* larger than $\frac{1}{64}$ could not have been of copper only, and as the proportion of silver may vary *ad libitum*, the value of particular coins must depend on the amount of silver which we imagine should have been included in their composition. Analysis is the main guide, but analysis is a troublesome matter, and further, for the reasons already given, analysis is not everything.

The commonest coins of billon have clearly a weight of 56 grains or 32 *ratis*. This type comprises the large series designated the bull and horseman type, and continues almost without interruption to the days of the Mughals. Now these coins are often of different types in the same reign, and usually one type contains ostensibly much more silver than another. This is particularly noticeable in the case of the billons struck by ʿAlāu-d-din Muḥammad (Nos. 135 and 136). The coin with the Persian legend on both sides is clearly worth more than that with a marginal legend in Nāgrī. It is probably safe to assume that the coins with a Nāgrī margin from the bull and horseman of Muḥammad bin Sām to the coins of Ghiāṣu-d-din Tughlaq (No. 163) had the same value. This value I would place at one-sixteenth of the *tanka*. It is true that the assay conducted by Thomas of twelve worn specimens of the common bull and horseman type (No. 107) of Nāṣiru-d-din Maḥmūd yielded too much silver for this allocation, but it is impossible to trust the bāzār analysis absolutely and it is equally difficult to assign to this type a higher value than one anna.

A billon coin of 56 grains or 32 *ratis* containing 6 *ratis* of silver is very nearly $\frac{1}{16}$ of the *tanka*. A coin with 12 *ratis*

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of silver and 20 *ratis* copper is one-eighth of the *tanka* and was known as a *hashtgānī*. A coin with 24 *ratis* of silver and 6 *ratis* of copper would be a *shānzdahgānī* or one-fourth of a *tanka*.

The first obvious type of *hashtgānī* is the coin of ʿAlāu-d-din Muḥammad with Persian legends on both sides (No. 135). This is followed by the rare billon of Shahābu-d-din ʿUmr (No. 141) and those of Qutbu-d-din Mubārak (Nos. 147 and 151) Nāṣiru-d-din Khusrū (No. 156) and Ghiāṣu-d-dīn Tughlaq (No. 164). The other billons of Mubārak, (at any rate Nos. 148 and 152), are *chahārgānīs* or $\frac{1}{16}$ of the *tanka*. This value may also be given to the small billons of Fīrōz Shāh and his successors. (I.M.C. No. 445. Thomas Nos. 229, 243, 269, 279). We cannot expect to find further *hashtgānīs* of this weight, as in the days of Muḥammad bin Tughlaq this coin changed its character to a marked extent.

That the *shānzdahgānī* was a known coin is clear from the forced currency type (No. 199) which claims to be one-fourth of the *tanka*. We probably find it in its true form among the so-called silver small pieces of Muḥammad bin Tughlaq, especially No. 192 and possibly No. 189. Of the others No. 194 is certainly a *hashtgānī*, while No. 193 and No. 190 are probably no more than half this value.

The large square billons of Qutbu-d-dīn Mubārak (Thos. 151*a* and I.M.C. No. 250) and the similar coin of Khusrū, now in the Lahore Museum, are puzzling. They contain a high proportion of silver, but they are not half-*tankas*. The maximum weight is 84 grains or 48 *ratis*, and if they were meant to represent *shānzdahgānīs* they would have a composition of silver and copper in equal proportions more or less. The apparent proportion of the two metals suggests the piece of 24 *jaitils* which is said to have existed in the days of Fīrōz Shāh, this possessing 36 *ratis* of silver to 12 of copper. This gives an inconvenient piece of six annas, which must have been very difficult to distinguish from the coin of 25 *jaitils*, also said to have been a coin of Fīrōz.

With the introduction of the *Khilāfati* currency of Muḥammad bin Tughlaq we find a new type of billon which proved extremely popular. This was a piece of some 140 grains or 80 *ratis* (Thos. No. 215) and it was repeated in the common undated billons bearing the name of Al Hākim b'amr Illah, and subsequently in the ordinary billons of Fīrōz Shāh (Nos. 228 and 230), Ẓafar (No. 247), Tughlaq II (No. 250), Abūbakr (No. 255), Muḥammad (No. 265), Sikandar (No. 272), Maḥmūd (No. 277), Muḥammad bin Farīd (No. 293), and ʿĀlam Shāh (No. 297). Now Thomas (pp. 282, 283) suggests that these coins, though possessing distinctive characteristics, bore very different values. His difficulty arose

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from the fact that he obtained a striking variation in the silver contents of different specimens, the amount ranging from 12 to 24 grains. As already stated, it is unthinkable that there were coins of equal weight and identical appearance which were intended to pass current as pieces of six, eight and ten *jaitils* simultaneously. If it were attempted at all, it is certain that the system could not have long survived, and we must be content to assume an average of 4½ *ratis* or 18·4 grains of silver and in consequence to regard all the coins of this type as *hashtgānīs*. As one-eighth of the *tanka*, such a coin would be of the greatest convenience, and the enormous quantities issued by Fīrōz Shāh and his predecessor must have done much to make this type the standard currency of the day. Fīrōz struck but little silver, so far as we can tell. Thomas boldly asserts that the *tanka* was not struck by this monarch, but this statement has been proved incorrect, and there is no reason why we should not in due course discover *tankas* corresponding in type to all the gold issues of the reign.

The introduction of the *'adalī* or silver coin of 80 *ratis* by Muḥammad bin Tughlaq tends to confuse the currency greatly. The silver *'adali* did not last more than a year or two, but at any rate it had the effect of establishing a decimal system side by side with the quaternary scale of immemorial antiquity. The brass tokens of Daulatābād are expressly described as *tankas* of 50 *jaitils* or *panjāhgānīs*, and the half-piece was a *nisfi* of 25 *jaitils*. Now before and after his disastrous experiment with brass, Muḥammad bin Tughlaq issued a billon coin of 140 grains which in many cases has obviously a high silver content. Thomas assumes that this was a perpetuation of the *'adalī*, but he was clearly wrong, as every piece, however silvery its appearance, has a considerable admixture of copper in its composition (Thos. No. 182). This coin runs on to 742 H. and was obviously in common use. If it were a coin of 24 *jaitils*, the silver in its composition would amount to some 64 grains, whereas a *nisfi* would have nearly 69 grains. I know of no analysis of these coins, but I would incline to the theory that they are *nisfis* of 25 *jaitils* and that their production was limited to the reign of Muḥammad bin Tughlaq. When we are told that coins of 24 and 25 *jaitils* were current in the days of Fīrōz Shāh, it does not follow that they were struck by that monarch.

Another problem arises in the coin described as of impure silver by Thomas (No. 261) struck in the joint names of Muḥammad and Fīrōz Shāh. This and the coin with امیر المومنین on the reverse, published by Rodgers, is of the full weight of the *tanka*. The type was reproduced by Tughlaq II, Ẓafar and subsequently by Muḥammad when sole king, up to the last year of his reign. The coin is very silvery, but is obviously

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billon. If three-fourths are silver, as seems probable, we have in this type the missing piece of 48 *jaitils* or twelve annas.

Before following up the later developments of billon coinage, we have to hark back to the smaller pieces, that is to say, those of less weight than 56 grains. Omitting the coins of Altamsh, whose minute issues are beyond guesswork, we start with the tiny *'adal* of Nāṣiru-d-dīn Maḥmūd, a coin of 12 grains. Thereafter the *'adal* runs up to 42 grains or 24 *ratis*, but this weight is unusually high and 20 *ratis* represents the general size of these pieces. In this type we have clearly the *dogānī*, a half-anna piece containing in the reign of Nāṣiru-d-dīn Maḥmūd three *ratis* of silver and the balance of copper, while subsequently the proportion of copper and therefore the size were increased for obvious purposes of convenience. The brass *dogānī* of Muḥammad bin Tughlaq retains the same weight of 20 *ratis*.

The billons of lower value than the *jaitil* instituted by Fīrōz Shāh are identified by Thomas in Nos. 231 and 232. If this is correct, the latter contains but half a grain of silver, and the coin itself justifies this theory. It is extremely rare, and in all probability it served little purpose, as the *jals* of pure copper would fill the need with less inconvenience.

Fīrōz Shāh also claims credit for the *shashgānī*, a seemingly unnecessary coin of six *jaitils* or one-and-a-half anna. This should contain the equivalent of $9\frac{3}{8}$ *ratis* of pure silver, and is consequently a coin very difficult to place. The only suggestion I can offer is that the 84-grain coin (Thos. No. 236) is a piece of six *jaitils*, and if this is the case, we may assume that the issue of such money ceased when the news of the accession of Abi 'Abdullah reached Dehli.

The billons of Ẓafar and Abūbakr with a square area have a weight of some 64 *ratis*. Their silver content varies to outward appearances, and they are clearly inferior in value to the *hashtgānī*. It is suggested that these again are *shashgānīs*, but in the absence of more definite information we are driven to mere speculation. It is hardly possible in any case to make more than an admittedly tentative allocation, but weight tells for something, and it is clearly improper to assume that the weight of any piece was determined arbitrarily and bore no relation to its intended value. Even the weights of the forced currency of Muḥammad bin Tughlaq are not devoid of meaning, in spite of all that has been asserted to the contrary. The substitute for the *tanka* or *'adalī* weighs 80 *ratis*, and the unnamed pieces (Nos. 197 and 198) are 64 *ratis* in weight and were obviously meant to represent coins of lower denominations. The brass quarter (No. 199) was of 40 *ratis*, while the *hashtgānī* was of 32 and the *dogānī* of 16 *ratis*. This scale does not correspond with the alleged values, it is true, but it indicates an ascending order of worth, and even under the mad

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scheme of substitution the unfortunate victims of caprice were taught by size and weight the orders of the sovereign.

A fresh complication ensues with the accession of Bahlol Lodī. This ruler appears to have been very modest in assuming the outward signs of sovereignty, and the absence of the gold and silver *tanka* bearing his name is very remarkable. Moreover, it is very unfortunate from a numismatic point of view, for we require evidence as to the relationship of silver to copper during the period, and more solid ground on which to trace the transitional stage from the old currencies of Delhi to the reforms inaugurated by Sher Shāh.

There would be little difficulty in regarding the billon of Bahlol and Sikandar as the lineal descendant, degenerate it may be, of the *hashtgānī*, were it not for two facts. While we can find coins bearing a close approximation to the requisite proportion of 18·4 grains of silver to 121·6 grains of copper, it is obvious that in many specimens the amount of silver has been reduced to a wholly unwarrantable extent, that is, if the coin is intended to be one-eighth of a *tanka*. On p. 368 Thomas gives a statement which must be regarded as authoritative. The assay conducted at the Calcutta mint supports the theory that the 140-grain billon of Sikandar was intended to pass as a *hashtgānī*, but only if the coins of the first ten years of his reign be ignored. In the case of these coins we get the miserable average of 2·7 grains of silver, and this would warrant the contention that these billons are no better than *dāms* and ran at 40 to the rupee. The coins of the subsequent years could not possibly have had this low value. They are better than *shashgānīs*, and are very fair specimens of the *hashtgānī*. The odd thing is that the coins of the early years of Sikandar, that is, those struck at Delhi, look to me as if they contained much more silver than the later products of his Agra mint. Some years ago I had to examine some thousands of these coins, and the resemblance in weight and colour between the latter coins of Bahlol and the earlier issues of Sikandar, as compared with the coarser coins of his later years, was very striking.

Thomas definitely accepts the view that the billon of Bahlol was the *bahlolī* and that 40 went to the full *tanka*. This, I submit, is unreasonable, if only for the reason that his crude assay yielded 15·3 grains of pure silver in one case and 14 in another. It is true that from one coin he failed to get any silver at all, but this single example proves nothing, and if we are to take forty of the ordinary billons of Bahlol we shall have a mass of metal which is worth four or five times the value assigned by Thomas.

Further it is incredible that the value of the *sikandarī* should have been twice that of the *bahlolī*; yet Thomas is positive that the former coin was raised in value to one-twentieth of the silver *tanka*. On his own showing this is wrong, for

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Sikandar was not likely to waste silver on his double *dāms*. In the face of the coins themselves, we are not to be convinced by an explanatory statement of Ferishta, whose ideas on ancient numismatics were positively childish.

Now Bahlol Lodī struck other coins than the large billon. His 140-grain copper (No. 315) is common and is clearly the descendant of the *jaitil*. It may not have been $\frac{1}{64}$ of the *tanka*, for this attribution in any case rests on a large assumption as stated above; but if we take it as it appears to be in reality, as $\frac{1}{80}$ of the *tanka*, we obtain a clue to the statements regarding the changed relationship of the small change of that day to the rupee. This means that the old *jaitil* has become the half-dām, and the fact marks an important stage on the road to the reformation of the currency. The 70-grain copper (No. 313) was a half-piece; but when we find a 55-grain billon (No. 312) clearly representing the old one-anna piece, it is difficult to resist the conclusion that the large billon is nothing but our old friend the *hashtgānī*.

That a further change came with the reign of Sikandar seems clear, for Sikandar struck no large copper pieces. At all events nothing but billon is known, and Thomas is confessedly in error when he states that No. 316 is of copper. Nevertheless it is difficult to believe that 20 of these coins went to the *tanka*. Possibly the number was changed to ten, and in that case the smaller coins, which alone appear in the reign of Ibrāhīm, foretell the advent of the dām. Several points have yet to be elucidated with regard to the Lodī coinage. Why did the 140-grain billon disappear after 920 H.? So far as can be ascertained, none is known save a belated specimen of 935 H. struck in the name of Sulṭān Maḥmūd bin Sikandar bin Bahlol, who apparently endeavoured to rally the Afghāns after the defeat of Pānīpat and was proclaimed king in Bihār in 935, only to fly before the army of the Mughals after a nominal reign of a few months. This coin, the identification of which was purely accidental, I had laid aside in order to study the date, without paying any attention to the obverse; the general appearance and texture so resembling that of the ordinary *sikandarī* that I failed to observe, as possibly many others have done, the significance of a piece which claims a niche in the temple of history as the last of the billons.

If the foregoing suggestions are rash and incapable of support, I make no apology. The object in view will have been attained if criticism leads to a more certain identification of well-known but nameless friends.

H. Nevill.

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216. Historical Notes on the Honorific Epithets of Mughal Mint-Towns.

It may be truly said of the Honorific Epithets of Mughal mint-towns that they open out to the curious inquirer one of the most interesting as well as instructive by-paths of numismatic study. Here, as elsewhere, Mr. Stanley Lane Poole deserves the credit of having led the way by tabulating in one of his indexes all the mint-titles which had arrested his attention. Twelve years afterwards, Dr. Taylor followed up the subject in the Centenary Memorial Volume of the Journal of the Bombay Branch of the Royal Asiatic Society. This second list is, as might be expected, not only more complete, but the classification has the merit of being a double one. Each epithet is first shown against all the mint-towns with which it is associated, and then each mint-town is mentioned along with all its titles. (*Loc. cit.*, 427-436.)

It is now sixteen years since Dr. Taylor wrote, and it is permissible to say that his useful monograph stands in need of some revision. The following tables are submitted with a historical commentary in which an attempt has been made to bring together all the passages in the historians which throw any light on the origin of these epithets. They have been prepared on the same lines, and the evidence in reference to each prefix has been re-examined so far as the writer's resources would permit. It is not necessary to call attention to all the changes, but two principal points of difference may be indicated. In the first place, Āṣafābād, Salīmgarh [Salīmābād], Shāhābād, Shergarh, Ṣaḥibābād, Fatḥābād, Farrukhābād, Muḥammadābād, Mūminābād, etc., have been treated not as true Honorific Epithets, but as Eponymous equivalents or alternatives. In the second, some titles resting upon tentative or conjectural decipherments which have had to be abandoned, *e.g.* بلدهٔ صفا و برج, etc. have been deleted along with two others, خسرو گیتي پناه and شاه گردون بارگاه, of which the meaning had been imperfectly apprehended. At the same time, an attempt has been made to specify the years or period of every reign during which each epithet figures on the coins. This has been done especially with reference to the earlier emperors, in whose times all sorts of alterations appear to have been frequently and somewhat capriciously introduced, and no attempt made to preserve anything like uniformity in the use of these complimentary appellations. When, on the other hand, matters had settled down, during the decline and fall of the empire, to a dead level of formal and even meaningless routine, it has not been thought necessary to mention the actual years. It is scarcely required in the circumstances, and is not calculated to add anything really valuable to our knowledge.

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HONORIFIC EPITHETS WITH THEIR MINTS.

بلدہ

Ujjain, Shāh Jahān, 1039 A.H.
Āgra, Akbar, 981 A.H.
Ilahābād, Aurangzeb, 1071 A.H.
Burhānpūr, Shāh Jahān (*niṣārs* only)
Bikāner, ʻĀlamgīr II (1 R.)
Sarhind, Akbar, 987 A.H.

بلدۂ فاخرہ

Burhānpūr, Aurangzeb (probably 1st year).

بندر

Dewal, Akbar, 42 R.
Lahrī, Akbar, 42 R.

بندر مبارک

Sūrat, Aurangzeb, 1070-71 A.H.

تیرتھ

Hardwār, Shāh ʻĀlam II, 1212-1214 A.H

حضرت

Dehlī, Akbar, 964-988 A.H.

خجستہ بنیاد

Aurangābād, Aurangzeb, 1100 A.H. to ʻĀlamgīr II.

خطّہ

Lakhnau, Akbar, 967 A.H. (N.S. XXV).
Kashmīr, Jahāngīr (Undated *Niṣār*).

دارالامان

Āgra, Humāyūn, 941-3 A.H.
Multān, Aurangzeb, 1069-1072 A.H.; ʻĀlamgīr II, 7 R.
Jammūn, Shāh ʻĀlam II, 1195-1200 A.H.

دارالبرکات

Nāgor (or Nāgpūr), Aḥmad Shāh (*Wh.*); ʻĀlamgīr II, Shāh ʻĀlam II.

دارالجہاد

Ḥaidarābād, Aurangzeb, 1099 A.H.-1118 A.H. Kām Bakhsh; Aʻaẓam Shāh (*Wh.*); Shāh ʻĀlam I (1 R).

دارالخلافت

Aḥmadābād, Akbar, 980 A.H.
Akbarābād, Shāh Jahān, 1038-9 A.H.; 1068 A.H.

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Akbarpūr Tānda, Akbar, 97x A.H.
Āgra, Bābar, 936 A.H.
,, Humāyūn, 937 A.H.-941 A.H.
,, Akbar, 965–988 A.H.
,, Jahāngīr, 1028 A.H. (*Niẓār*).
,, Shāh Jahān, 1037-8;
Bahrāīch, Akbar, 970-978 A.H.
Jaunpūr, Akbar, 972-988 A.H.
Dogāon, Akbar, 974-986 A.H.
Daulatābād, Shāh ʻĀlam II.
Shāhjahānābād, Shāh Jahān, 1058 A.H. to Bahādur Shāh II.
Shāhgarh Qanauj, Akbar, 968-9 A.H.
Gorakpūr, Akbar, 984 A.H.
Lāhor, Humāyūn, 938-940 A.H.
,, Akbar, 976 A.H.
Lakhnau, Akbar, 97x-988 A.H.
Mālpūr (?), Akbar, 984 A.H.

دارالخلافت خطّه

Awadh, Akbar, 966-97x.

دارالخلافت مقام

Gwāliar, Akbar, 96x A.H.

دارالخير

Ajmer, Aurangzeb, 30 R—50 R.
,, Shāh ʻĀlam I, 1 R.
,, Farrukh-siyar, 7 R to Shāh ʻĀlam II.

دارالسرور

Burhānpūr, Shāh ʻĀlam I (1 R) to Shāh ʻĀlam II.
Sahāranpūr, Shāh ʻĀlam II, 1209-1215 A.H.

دارالسلام

Dogāon, Akbar, 986-1003 ? A.H.
Mandisor, Shāh ʻĀlam II, 1203 A.H.

دارالسلطنت

Aḥmadābād, Akbar, 981-996 A.H.
Burhānpūr, Jahāndār, 1124 A.H.
Fatḥpūr, Akbar, 982-989 A.H.
Korā, Akbar, 37 (?) R. [*H. N. W.*]
Lāhor, Akbar, 976-989 A.H.
Fatḥpūr, Shāh Jahān, 1 R.
Lāhor, Shāh Jahān, 1 R to ʻĀlamgīr II

دارالضرب

Patna, Akbar, 984; 987 A.H.
(?) Jaunpūr, Humāyūn, 939 A.H.
,, Akbar (Undated).
Kālpī-Muḥammadābād, Akbar, 963-4 A.H.[1]

[1] A Fatḥpūr fulūs of 979 A.H. has an honorific which was read as

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دارالضرب خطّه
Kālpī, Akbar, 964-968 A.H.

دارالضرب خطّهٔ متبرک
Jaunpūr, Humāyūn, 937-943 A.H.

دارالضرب قلع
Āgra, Bābur or Humāyūn, 936-7 A.H.

دارالظفر
Bijāpūr, Aurangzeb, 1097 A.H. to Farrukhsīyar.
Zebābād (?), Shāh ʿĀlam II, 1218 A.H. (*Wh.*)[1]

دارالعدل
Āgra, Humāyūn, 943 A.H.

دارالفتح
Ujjain, Aurangzeb, 1073 A.H. to Shāh ʿĀlam II except Aḥmad Shāh.

دارالفلوس
Muḥammadābād Banāras, Shāh ʿĀlam II.[2]

دارالملک
Kābul, Aurangzeb, 1094 A.H. to Muḥammad Shāh, 1151 A.H.

دارالملک حضرت
Dehlī, Humāyūn, 940-2 A.H.
,, Akbar, 977-979 A.H.
(Fatḥpūr) ? Akbar, 979 A.H.

دارالمنصور
Ajmer (?), Akbar, 979 A.H.
Jodhpūr, Aḥmad Shāh to Shāh ʿĀlām II.

دارالضرب by Rodgers. I have not mentioned it as the reading is almost certainly wrong and a satisfactory solution of the difficulty is still to seek.

[1] In the First Supplement to his Mint-list, Mr. Whitehead called attention to a Rupee in the Bleazby collection, dated 1218-45 R.—the name on which had been "tentatively read as Dāru-ẓ-Ẓafar, Zainābād." It was added that "a duplicate already existing in the British Museum had been labelled 'Sirdhāna' by Prinsep. (Num. Sup. XXV, 236.) Mr. Whitehead is now of opinion that the correct reading is '*Zebābād*' and I am inclined to accept the emendation. We know that Shāh ʿĀlam II bestowed upon Begam Samrū the title *Zebu-n-nisā* to mark his appreciation of the valuable service rendered by her in 1788. A.C.

[2] The epithet on a fulūs of 981 A.H. has been deciphered by Mr. Whitehead as دارلفلوس and the coin has been ascribed by him to Tatta, (P.M.C., No. 880), but this is open to serious doubt, and I have thought it best to keep دارلفلوس تتّه out of these lists.

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در راه دکن
Urdū, Jahāngīr (1025 A.H. 11 R.)

زین البلاد
Aḥmadābād (?), Muḥammad Shāh.

زینت البلاد
Aḥmadābād, Raf'īu-d-darajāt.

سرکار
Lakhnau, Akbar, 967 A.H.

سوای
Jaipūr, Muḥammad Shāh. 1153 (?) A.H. to Shāh 'Ālam II.

شهر
Anhirwāla Pattan, Akbar, 984-985 A.H.

شهر معظّم دارالسلطنت
Aḥmadābād, (?) Akbar, 981 A.H.

شهر مکرّم
Champānīr, Humāyūn, 942 A.H.

صوبه
Awadh, Shāh 'Ālam II, 1229 A.H. 26 R.

ظفر قرین
Urdū, Akbar, 984 A.H.; 1000 A.H.; 35 R.—50 R; Undated; Shāh Jahān, (Niṣār).

فرخنده بنیاد
Ḥaidarābād, Shāh 'Ālam I to Muḥammad Shāh, except Raf'īu-d-darajāt.

قصبه
Amīrkot (?), Akbar, 979, 989 A.H.
Pānīpat, Shāh 'Ālam II.

قطعه (?)
Barelī, Shāh 'Ālam II, 1209-1220 A.H.

قلع
Āgra, Bābur, 936 A.H.
Alwar, Akbar (Early type).
Pūnch, Shāh 'Ālam II ? (*Taylor*).[1]
Gwāliar, Akbar, 987 A.H.

مستقرالخلافت
Akbarābad, Aurangzeb, 1096 A.H. to end; Shāh 'Ālam I (1 R).

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[1] Dr. Taylor notes that قلع is prefixed to the name of 'Pūnch' or 'Būnch' on a copper coin of Shah 'Ālam II (B.B.R.A. Society's Journal,

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Ajmer, Shāh ʻĀlam I, 1 R to
Farrukhsīyar, 1 R-6 R.
Akbarābād, Farrukhsīyar, 5 R to Shāh ʻĀlam II.

مستقرالملک

Akbarābād, Shāh ʻĀlam I, 1 R to
Farrukhsiyar, 5 R.
ʻAẓīmabad, Farrukhsīyar, 3 R to 7 R.

مفتوحه

Udaypūr-Muḥammadābād, Akbar, 984 A.H.

مقام قلع

Gwāliar, Akbar, 968, 987 (?) A.H.[1]

MINTS WITH THEIR HONORIFIC EPITHETS.

Ajmer

دارالمنصور (?)

دارالخیر

مستقرالخلافت

Ujjain

بلده

دارالفتح

Aḥmadābād

دارالخلافت

دارالسلطنت

زین البلاد (?)

زینت البلاد

شهر معظم دارالسلطنت (?)

Centenary Volume, 432, 436). The only mention of 'Pūnch' in Mr. Whitehead's Mint-list is under Aurangzeb (AR), and the authority cited is T, i.e., Dr. Taylor himself. Mr. Burn enters under 'Punch' an Aurangzeb Rupee belonging to Dr. Taylor and a Shah ʻĀlam II fulūs in the Cabinet of Dr. White King. In the White King Sale Catalogue itself, the name of 'Pūnch' is nowhere found, though a fulūs of *Kila Bundī* "avec feuille et lance comme marques" is registered. (Part III, No. 4179.)

It would be exceedingly rash to arbitrate between these authorities in the absence of the coins themselves, though it is clear that there must be a mistake somewhere. At the same time there would appear to be grounds for thinking that قلع is prefixed to the name of some mint on a *fulūs* of Shāh ʻĀlam II.

[1] My acknowledgments are due to Mr. R. B. Whitehead for scrutinizing this list and calling attention to some errors and omissions.

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Udaypūr

مفتوحه

Urdū

در راه دکن

ظفر قرین

Akbarābād

دارالخلافت

مستقرالخلافت

مستقرالملک

Akbarpūr-Tānda

دارالخلافت

Āgra

بلده

دارالامان

دارالخلافت

دارالضرب قلعه

قلع

Alwar

قلع

Ilahābād

بلده

Amīrkot (?)

قصبه

Awadh

دارالخلافت خطهٔ

صوبه

Aurangābād

خجسته بنیاد

Burhānpūr

بلده

بلده فاخره

دارالسرور

Barelī

قطعه (?)

Bahrāich

دارالخلافت

Bījāpūr

دارالظفر

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Bīkāner

بلده

Pānīpat

قصبه

Patna

دارالضرب

Pattan (Anhirwāla)

شهر

Pūnch (?)

قلع

Jammūn

دارالامان

Jaunpūr

دارالخلافت

دارالضرب خطهٔ متبرک

Jodhpūr

دارالمنصور

Jaipūr

سواي

Champānīr

شهر معظّم

Haidarābād

دارالجهاد

فرخنده بنیاد

Dogāon

دارالخلافت

دارالسلام

Dehlī

حضرت

دارالملک حضرت

Dewal

بندر

Sarhind

بلده

Sūrat

بندر مبارک

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Sahāranpūr
دارالسرور

Shāhjahānābād
دارالخلافت

'Aẓīmābād
مستقر الملک

Fatḥpūr
دارالسلطنت
دارالملک حضرت (?)

Kābul
دارالملک

Kālpī
دارالضرب
دارالضرب خطّه

Kashmīr
خطّه

Gwālīar
دارالخلافت مقام
قلع
مقام قلع

Gorakpūr
دارالخلافت

Lāhor
دارالخلافت
دارالسلطنت

Lakhnau
خطّه
دار الخلافت
سرکار

Lahrī
بندر

Multān
دارالامان

Mandisor
دارالسلام

Nāgor
دارالبرکات

Hardwār
تیرتھ

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Honorific Epithets according to Reigns

Bābur.

قلع (Agra) ; دارالضرب قلع (Āgra) (?) ; دارالخلافت

Humāyūn.

دارالامان (Āgra) ; دارالخلافت (Āgra, Lāhor) ; دارالضرب قلع (Āgra) (?) ; دارالضرب خطّه متبرک (Jaunpūr) ; دارالعدل (Āgra) ; دارالملک حضرت (Dehlī) ; شهر مکرّم (Champāner).

Akbar.

بلده (Āgra, Sarhind) ; بندر (Dewal, Lahrī) ; حضرت (Dehlī) ; خطّه (Lakhnau) ; دارالخلافت (Aḥmadābād, Akbarpūr-Tānda, Āgra, Bahrāich, Jaunpūr, Dogāon, Shāhgarh-Qanauj, Gorakpūr, Lāhor, Lakhnau, Mālpūr (?)) ; دارالخلافت خطّه (Awadh) ; دارالخلافت مقام (Gwalīar) ; دارالسلام (Dogāon) ; دارالسلطنت (Aḥmadābād ; Fatḥpūr, Kora, Lāhor) ; دارالسلطنت شهر معظّم (Aḥmadābād) ; دارالضرب (Patna, Jaunpūr, Kālpī) ; دارالضرب خطّه (Kālpī) ; دارالملک حضرت (Dehlī, Fatḥpūr (?)) ; دارالمنصور ? (Ajmer) ; سرکار (Lakhnau) ; شهر (Anhirwāla-Pattan) ; ظفر قرین (Urdū) ; قلع (Āgra, Alwar, Gwāliar) ; مفتوحه (Muḥammadābād-Udaypūr) ; مقام قلع (Gwāliar).

Jahāngīr.

خطه (Kashmīr) ; دارالخلافت (Āgra), *niṣārs* only ; در راه دکن (Urdū).

Shāh Jahān I.

بلده (Ujjain, Burhānpūr) ; دارالخلافت (Akbarābād, Āgra, Shāhjahānābād) ; دارالسلطنت (Fatḥpūr, Lāhor) ; ظفر قرین (Urdū.)

Aurangzeb.

بلده (Ilhābād) ; بلده فاخره (Burhānpūr) ; بندر مبارک (Sūrat) ; خجسته بنیاد (Aurangābād) ; دارالامان (Multān) ; دارالجهاد (Ḥaidarābād) ; دارالخلافت (Shāhjahānābād) ; دارالخیر (Ajmer) ; دارالسلطنت Lāhor) ; دارالظفر (Bijāpūr) ; دارالفتح (Ujjain) ; دارالملک (Kābul) ; مستقر الخلافت (Akbarābād).

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A'AẒAMSHĀH.

خجسته بنیاد (Aurangābād) ; دارالجهاد (Ḥaidarābād) ; دارالفتح (Ujjain).

KĀM BAKHSH.

دارالجهاد (Ḥaidarābād) ; دارالظفر (Bijāpūr).

BAHĀDUR SHĀH SHĀH 'ĀLAM I.

خجسته بنیاد (Aurangābād) ; دارالجهاد (Ḥaidarābād) ; دارالخلافت (Shāhjahānābād) ; دارالخیر (Ajmer) ; دارالسرور (Burhānpur) ; دارالسلطنت (Lāhor) ; دارالظفر (Bijāpūr) ; دارالفتح (Ujjain) ; دارالملک (Kābul), فرخنده بنیاد (Ḥaidarābād) ; مستقر الخلافت (Akbarābād, Ajmer) ; مستقرالملک (Akbarābād).

JAHĀNDĀR SHĀH.

خجسته بنیاد (Aurangābād) ; دارالخلافت (Shāhjahānābād) ; دارالسرور (Burhānpūr) ; دارالسلطنت (Burhānpūr, Lāhor) ; دارالظفر (Bijāpūr) ; دارالفتح (Ujjain) ; دارالملک (Kābul) ; فرخنده بنیاد (Ḥaidarābād) ; مستقرالملک (Akbarābād) ; مستقرالخلافت? (Ajmer).

FARRUKHSIYAR.

خجسته بنیاد [Aurangābād] ; دارالخلافت (Shājahānābād) ; دارالخیر (Ajmer) ; دارالسرور (Burhānpūr) ; دارالسلطنت (Lāhor) ; دارالظفر (Bijāpūr) ; دارالفتح (Ujjain) ; دارالملک (Kābul) ; فرخنده بنیاد (Ḥaidarābād) ; مستقر الخلافت (Ajmer, Akbarābād) ; مستقر الملک (Akbarābād, 'Aẓīmābād).

RAF'ĪU-D-DARAJĀT.

خجسته بنیاد [Aurangābād] ; دارالخلافت (Shājahānābād) ; دارالخیر (Ajmer) ; دارالسرور (Burhānpūr) ; دارالسلطنت (Lāhor) ; دارالفتح (Ujjain) ; دارالملک (Kābul) ; زینت البلاد (Aḥmadābād) ; مستقر الخلافت (Akbarābād).

SHĀH JAHĀN II.

خجسته بنیاد [Aurangābād] ; دارالخلافت (Shājahānābād) ; دارالخیر (Ajmer) ; دارالسرور (Burhānpūr) ; دارالسلطنت (Lāhor) ; مستقر الخلافت (Ujjain) ; فرخنده بنیاد (Ḥaidarābād) ; دارالفتح (Akbarābād).

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MUḤAMMAD IBRAHĪM.

دارالخلافت (Shāhjahānābād).

MUḤAMMAD SHĀH.

خجسته بنیاد [Aurangābād]; دارالخلافت (Shāhjahānābād); دارالسلطنت (Lāhor); دارالسرور (Burhānpūr); دارالخیر (Ajmer); زین البلاد (Aḥmadābād ?); دارالفتح (Ujjain); دارالملک (Kābul); فرخنده بنیاد (Ḥaidarābād); مستقر الخلافت سوای (Jaipūr); (Akbarābād).

AḤMAD SHĀH.

خجسته بنیاد [Aurangābād]; دارالبرکات (Nāgor or Nāgpūr); دارالخلافت (Shāhjahānābād); دارالخیر (Ajmer); دارالسرور (Burhānpūr); دارالسلطنت (Lāhor); دارالمنصور (Jodh pūr); سوای (Jaipūr); مستقرالخلافت (Akbarābād).

'ĀLAMGĪR II.

(بلده) (Bikāner); خجسته بنیاد (Aurangābād); دارالامان (Multan); دارالبرکات (Nāgor or Nāgpūr); دارالخلافت (Shāhjahānābād); دارالخیر (Ajmer); دارالسرور (Burhānpūr); دارالسلطنت (Lāhor); دارالفتح (Ujjain); دارالمنصور (Jodhpūr); سواي (Jaipūr); مستقرالخلافت (Akbarābād).

SHĀHJAHĀN III.

دارالخلافت (Shāhjahānābād); مستقرالخلافت (Akbarābād).

SHĀH 'ĀLAM II.

تیرتة (Hardwār); دارالامان (Jammūn); دارالبرکات (Nāgor or Nagpūr); دارالخلافت (Daulatābād, Shāhjahānābād); دارالخیر (Ajmer); دارالسرور (Burhānpūr and Sahāranpūr); دارالسلام (Mandisor); دارالظفر (Zebābād ?); دارالفتح (Ujjain); دارالفلوس (Muḥammadābād-Banāras); دارالمنصور (Jodhpūr); سوای (Jaipūr); صوبه (Awadh); قصبه (Pānīpat); قطعه ? (Barelī); قلع (Pūnch ?); مستقرالخلافت (Akbarābād).

BĪDĀR BAKHT.

دارالخلافت Shāhjahānābād.

AKBAR II.

دارالخلافت Shāhjahānābād.

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Bahādur Shāh II.

دارالخلافت Shāhjahānābād.[1]

It will be seen from these tables, especially the last, that a very small beginning was made by Bābur with only two or three epithets for a single town, Āgra. In the reign of his son, the number rises to seven, of which four دارالخلافت , دارالضرب قلع, دارالامان and دارالعدل are prefixed to the name of the same city (Āgra). Another place (Lāhor) is also called دارالخلافت. This disregard for anything like rule or method in the distribution of these appellations is carried to much greater length during the first half of Akbar's reign. We can now reckon so many as twenty separate titles, but the confusion also is proportionately increased, and no less than thirteen different towns of all degrees of eminence are attended by the high sounding designation, 'Seat of the *Khilāfat*.' At the same time, two different places are called بلده, two more are characterised as بندر, three others are styled دارالضرب, four are distinguished as دارالسلطنت, and each of six other cities (Aḥmadābād, Awadh, Dehlī, Kālpī, Gwāliar and Lakhnau) is honoured by two different attributives.

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[1] It might be as well to say that on the coins we have دارالخلافة دارالسلطنة - مستقر الخلافة and بلدة, and Mr. Lane Poole's transcriptions are *Dār-al-Khilāfah*, *Mustakarr-al-Khilāfah*, *Dār as-Saltānah*, and *Baldat* (B.M.C. Introd. lix.) This is in accordance with the rules of *Arabic* grammar and pronunciation, which do not necessarily apply to Persian. In Persian as well as Hindūstānī, we say *Khilāfat*, *Salṭanat* and *Baldah*. Mr. Nelson Wright and Mr. Whitehead have خلافة - سلطنة and بلدة in Persian, but write *Khilāfat*, and *Salṭanat* in English. In the historical works from which these notes and illustrations are almost entirely drawn, there is considerable diversity in the manner of spelling these words. In the Bibliotheca Indica Editions of Badāonī (Vol. II), the *Iqbālnāmā* and *Khāfi Khān* (Vol. II), خلافت and سلطنت only arrest attention, and the other forms are not at all found or are exceedingly rare. In the first volume of the *Bādishāhnāma* in the same series, the words are written in both ways, but خلافت and سلطنت are overwhelmingly preponderant. In the *Akbārnāma*, *'Ālamgīrnāma* and the *Maaṣir-i-'Ālamgīrī*, خلافة and سلطنة are decidedly in favour, and in the second volume of the *Bādishāhnāma* they only seem to be tolerated.

In these circumstances, it may be safely said that neither of these forms is wrong, and that both are indifferent or almost equally correct. It is not easy to make a choice, and it is not without some hesitation that I have transcribed the ت in full, and this has been done only because it seems to be much more in accordance with the *Persian* system of pronunciation.

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Then all this jumble of names and titles comes sharply to an end, and the Ilāhī issues of the last two decades of the reign exhibit no epithets at all. They continue to be *generally* eschewed on the artistic and interesting issues of Jahāngīr,[1] though they are freely employed by himself in his remarkable 'Autobiography.' They are then revived by Shāh Jahān, but there is still no conşcious attempt to reserve a certain epithet for a specified town, or to restrict a particular town to a characteristic epithet. Thus, Fatḥpūr and Lāhor are both styled دارالسلطنت, and first Āgra, then Akbarābād, then Shāhjahānābād and lastly Akbaṛābād again are successively entitled دارالخلافت. At the same time, Ujjain and Burhānpūr share the designation بلده between them. It will be seen that though there is a revival of the old custom, it is still on a very limited scale and the total number of prefixes, is only three. With the accession of Aurangzēb, they come again into considerable vogue, and the number mounts up to thirteen, of which no less than nine are so far new that they had never figured on the mintages of any of the preceding rulers of his house. Aurangzeb also introduced for the first time and maintained throughout his long reign a commendable uniformity in their application. Each of these thirteen *sobriquets* was strictly reserved for an individual mint and no mint was permitted to appropriate more than one title.

Three new designations (مستقرالملك , دارالسرور , فرخنده بنیاد) were added by Bahādur Shāh Shāh 'Ālam I, and one or two other changes also were made by him which were responsible for some temporary confusion. This was however eliminated by Farrukhsiyar who consigned his grandfather's innovations to oblivion and reverted to the old arrangements of Aurangzeb. He transferred مستقرالملك to his own favourite city 'Aẓīmābād, but the title itself perished with him and 'Aẓīmābād also lost its preferment. The epithets had now been systematised, and become more or less matters of mere form. The single new feature of Raf'īu-d-darajāt's mintages was the application of زینت البلاد to Aḥmadābād. The two innovations of Muḥammad Shāh were the conjunction of the title سوای with the name of Jaipūr and the use of the epithet زین البلاد for a place still un-

[1] The exceptions are not important, but may be noted here. دارالخلافت is prefixed to the name of Āgra on a niṣār of 1028 A.H. in the Panjāb Museum (No. 1186), and خطّه to that of Kashmīr on an undated niṣār which was in the White King collection (Catalogue, Part III, No. 3746). There is also a unique rupee of 'Urdū *dar rāh-i-Dakan*,' but this descriptive suffix has, strictly speaking, nothing honorific about it.

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determined, of Aḥmad Shāh the prefixing of دارالبرکات to the name of Nāgor and of دارالمنصور to that of Jodhpūr. In the reign of 'Ālamgīr II, Bikāner is for the first time styled بلدهٔ. The appropriation of the distinctive appellations of old Musalmān cities by the Rājpūt and Marāṭhā rulers of the day reached a climax under the second Shāh 'Ālam. The Dogra chief of Jammūn took a fancy to دارالامان, Sindhiā thought دارالسلام would be 'just the thing' for Mandisor, the Marāṭhā (?) masters of Daulatābād [1] would have nothing less high-sounding than دارالخلافت, and Sahāranpūr must be called دارالسرور. Three new titles also were devised, تیرتهٔ for Hardwār, قطهٔ for Bareli, and دارالفلوس for Banāras. Nothing could be more typical of the period itself, or of the total disruption of the Empire which it witnessed, than the unauthorized assumption by the Hindu chiefs of powers and dignities and titles which were often used in the Emperor's name against his person.

After this preliminary survey, let me proceed with the historical commentary which has been divided into two parts. In the first, an attempt has been made to throw such light as is possible in the circumstances, on the origin and significance of the most remarkable or distinctive titles with a view to investing these shadowy prefixes with a modicum of reality.

In the second, references have been given to all those passages in the published works of contemporary historians in which honorifie epithets are associated with the names of the towns.

Part I.

بلدهٔ فاخره (Sumptuous, rich or resplendent town) is the epithet of Burhānpūr on a unique coin in the Panjāb Museum (No. 1617) which is undated, but which must be reckoned among the earliest of Aurangzeb's silver issues. That Emperor had often resided at Burhānpūr, when prince-governor of the Ṣūbas of the Dekkan, and it was there that he had fallen madly in love with the fair Zainābādī, so named from Zainābād, one of its suburbs. Burhānpūr was, in those days, one of the greatest industrial and commercial centres of the country, and its wealth and grandeur are often extolled by contemporary travellers and historians. Abūl Faẓl speaks of it as "a large city three kos distant from the Taptī." It was

[1] These *Dāru-l-Khilāfati Daulatābād* Rupees have been never published and I know them only from a casual mention of them in Mr. Whitehead's P.M. Catalogue, Introd. p. lxxiv. As the date is unfortunately not given, it is impossible to say by whom they were issued, though we know that Daulatābād was for about four years in the possession of the Mahrattas. I propose to discuss the point more fully on another occasion.

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adorned by many gardens in which the sandal wood grew, was inhabited by people of all countries, and handicraftsmen of all sorts drove there a thriving trade. Jarrett, *Āīn.* II. 223. It is said to have been "greatly embellished" under Akbar and Jahāngīr (Imp. Gaz., IX, 104), and Tavernier thus writes of it: "The government of this province is so important that it is conferred only upon a son or uncle of the king, and Aurangzeb, who now reigns was for a long time governor of Burhānpūr during the reign of his father. ....There is a large trade in this town, and both at Burhānpūr itself and in all the province an enormous quantity of very transparent muslins are made, which are exported to Persia, Turkey, Muscovie, Poland, Arabia, Grand Cairo, and other places." (*Travels*, ed. Ball, I, 51.) The city was plundered by Shambhājī in 1685 (Grant Duff, Rep. 147), and Khāfī Khān in his account of that event informs us that Burhānpūr and Aurangābād were "spoken of as the capitals of the Imperial dynasty," پایتخت پادشاهان گفته می شدند (Text, II, 272, l. 7, E.D., VII, 305-6). He adds that it had seventeen rich suburbs, and that one of them, Bahādarpūr, had so many merchants and bankers in it that jewels, money and goods from all parts of the world were found there. (E.D., VII, 306.)

صرافان و تجاران صاحب لکوک در آنجا می بودند و از جواهر و زر وافر و اقسام جنس هفت اقلیم و مال بیشمار همه بنادر لکها در هردکان موجود بود *

Text II, 272-3.

Here probably we have the *rationale* of the epithet. We must look for it in the wealth of "the bankers and merchants who were owners of lacs, the jewels and gold and goods of all the seven climes which were exposed for sale in its shops," and the palaces, mosques and gardens with which, in those days, it was adorned.

I have not found in the histories any example of the association of the name of Burhānpūr with this title, but then we have to remember that it occurs only on a rupee of which no duplicate has been discovered.[1]

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[1] Bukhāra is styled بلدهٔ الفاخرهٔ on the coins of the Chaghatāi Mughals. Oliver, J.A.S.B., 1891, p. 10 (No. 1).

In the *Rauzatu-s-Ṣafā* (Bombay Lithograph, History of Sulṭān Ḥusain Bāiqrā, Book VII, 8, 25, 89) and the *Ḥabību-s-siyar* (Bombay Lithograph, History of Tīmūr and his Descendants, III, iii, 109, 116, 128, 134), the same title is prefixed to the name of Herāt, which was at the time (latter half of the 15th century), "the most magnificent city of the East, and celebrated not merely for the splendour and dignity of its court, but the architectural beauty of its mosques, tombs, colleges and palaces." Erskine, History of Bābar and Humāyun, I, 77. Bukhārā and Herāt were both great commercial and industrial centres also.

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Sūrat is called بندر مبارک 'Blessed port' on some of the early rupees of the 'Puritan' Aurangzeb. The most probable explanation of the designation is that "it was the port of departure for the pilgrimage to Mecca." (I.M.C., III, Introd. lxxviii). This is borne out by the statement that it was also spoken of as the 'Gate of Mecca' (Imp. Gaz. XXIII, 155).[1] There exists, however, in a history of the city written by a Musalmān named Bakhshī Miān, a local tradition which deserves mention. The epithet is there traced to the Gujarāt Sulṭān Maḥmūd Laṭīf, in whose reign the existing fort was erected by Safī [Ṣafar] Āghā, entitled Khudāwand Khān, to check the inroads of the Portuguese (A.H. 947, A.C. 1540). It is said that Khudāwand Khān who was a favourite Turkish slave of the Sulṭān submitted for his sanction before beginning operations, three different plans. "The king chose the one that placed the castle on the bank of the river, and under the plan wrote the word *Mubārak* or the 'prosperous' hence the city up to this day is called *Sūrat bandar Mubārak*." (Bombay Gazetteer, II, 72, Note 1.) The story may or may not be an *ex post facto* invention. It is certain, however, that the epithet is not found in any of the historians of Akbar, Jahāngīr or Shāh Jahān. Nor is there any recognition of it in the provincial history named the *Mirāt-i-Sikandarī*. بندر سورت is exceedingly common, but بندر مبارک سورت occurs only twice

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[1] Firishta speaks of بندر جدّه مبارک (Lakhnau Lithograph. II, 407. l. 20), 'the blessed port of Jedda,' because it was the place of disembarcation for the pilgrims from Hindustan to the 'Holy places.'

In the excellently-compiled Biographical Dictionary called the *Māaṣiru-l-Umarā*, the author quotes an extract from a letter addressed by Shāh Jahān to his father in the beginning of their quarrel. In this the Prince begs the Emperor "to assign to him in Jāgīr the Bandar-i-Surat which is the Gate of Mecca, that he might retire there."

* بندر سورت که دروازهٔ مکّه است عنایت فرمایند که منزوی شوم

Op. Cit. I, 147.16.

There is nothing corresponding to this statement in the *Tūzuk* of the Emperor himself, or the *Iqbālnāma* of his Secretary, Mu'atamad Khān. We may therefore, presume that the words are borrowed from the *Māāṣir-l Jahāngiri* of Kāmgār Husainī or some other unpublished history of the period.

Abū Turāb Walī (died *C.* 1005 A.H. 1596 A.C.) speaks of the ports of Gujarāt as the Gates of Mecca.

* دروازهٔ مکّه که بنادر گجرات باشند

Tārikh-i Gujarāt, Bibl. Ind. Text 90, 1, 12.

It may be added that بندر مبارک سورت occurs at least six times in the *Ma'aṣiru-l-Umarā* (*Vide* I, 289, 373, 412, 578; III, 507, 731).

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in the *Maāṣir-i-ʿĀlamgīrī* and but once in Khāfī Khān. Even on the coins, its vogue is limited to about two years, and it is dropped in the 3rd year of the reign.

حضرت دهلی appears frequently on the early issues of Akbar, and دارالملک حضرت دهلی which is found on the copper coins of Humāyūn also figures, sometimes, on the mintages of his son. "The first part of this double title was extensively associated," says Mr. Whitehead, "with the name of the capital on the *copper* coins of the Dehlī Sultans, and the second part on those in *silver* and *gold*." (P.M.C. Introd., lxxv.). But there does not seem to have been any fixed rule or usage in the matter. حضرت alone is found occasionally throughout the 'Paṭhān' series on Copper and Billon Coins also. (*Cf.* I.M.C., II, Nos. 80-1, 87-8, 160, 168-9, 185-6, 241, 357-8, 414-447, 457-8, 478, 495, 501-4, 526-8, 535, 546-571.) Again, دارالملک, though less frequently, arrests attention on the issues in silver (*Ibid.*, Nos. 245-6). حضرت is prefixed to the names of Deogīr and Daulatābād on the coins of the 'Great Moneyer,' Muḥammad Tughlaq (*Ibid.*, 307-8, 396), and the combination حضرت دارالخلافت is characteristic of the mintages of Quṭbuddīn Mubārak (*Ib.*, 243, 247, 249 and 269). On the coins of the Sulṭāns of Bengal, their capitals Firūzābād and Lakhnauti are styled حضرت, and Sunārgāon is called حضرت جلال (*Ibid.*, p. 142). Similarly, Aḥsanābād (Gulbarga) is called حضرت on the coins of the Bahmanīs and Shādiābād (Mandū) bears the same epithet on those of the Khiljī rulers of Mālwa. (*Ibid.*, Bahmanī Coins, Nos. 1, 5-13; Mālwa Coins, Nos. 15-17, 23-25, 34-36.) But this Shādiābād is, at the same time, qualified as دارالملک also (*Ibid.*, 2-14, 30-33, 37, 39-40).

In all these cases, 'Ḥaẓrat' refers to حضرت سلطان, i.e. the August or Royal Presence or His Majesty. We even now speak of the chief town of a district as the *Ḥuẓūr* Taḥṣīl, the Taḥṣīl which is "in the حضور or presence of the Collector and other government officials". Beames in Elliot, Supplemental Glossary, II, 86 note. See also Hobson-Jobson, ed. Crooke, *s.v.* Huzoor; Thomas, Chronicles, p. 150.

خجسته بنیاد 'Of auspicious foundation,' makes its appearance on the coins of Aurangzeb for the first time in the 33rd year of his reign (1100 A.H.). The city founded by him during his second viceroyalty of the Southern provinces in the neighbourhood of the somewhat older town built by Malik Ambar was, Khāfī Khān tells us, first called Aurangābād. (*Bibl. Ind.* Text, I, 489.) The earliest known coins of this

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Emperor—the gold muhr of 1070 A.H. (I.M.C. III, No. 1123) and the rupee of 1071 A.H. (B.M.C., No. 730)—both bear that name only. The epithet خجسته بنیاد is not found in the *'Ālamgīrnāma*, a voluminous contemporary chronicle of the first ten years of the reign which was completed and dedicated to the Emperor in the 32nd year. (E.D. VII, 174.) Its author uses several synonymous expressions, e.g.

اورنگاباد فیض بنیاد ,بلدهٔ فیض بنیاد اورنگاباد ,خطه فیض بنیاد اورنگاباد خطهٔ دولت بنیاد اورنگا باد, but the specific adjective is never prefixed to the name of the town. In the *Maāṣir-i-'Ālamgīrī* as well as the *Muntakhabu-l-Lubāb* of Khāfī Khān, the new name occurs frequently, but both those works were compiled *after* the death of Aurangzeb.

Neither of these writers gives the reason of the appellation, of which there is a tacit recognition in their pages, but it is not difficult to understand it. It is common knowledge that it was during his stay in Aurangābād that Aurangzeb accumulated those resources in men, money and munitions which afterwards enabled him to defeat his brothers in the struggle for the throne.[1] It was from Aurangābād that he had started on Friday, the 12th of Jumād I, 1068 A.H. "at a miraculously-blessed and auspicious hour which was the choice of persons of wisdom and foresight, and the ornament of the ephemeris in the almanacs of Creation, 'with a whole world of majesty and power and glory and dignity,' and in the company of victory and good luck and good fortune."

در ساعتي كرامت طراز ميمنت اثر كه مختار اهل دانش و بينش و زيب جدول تقويم آفرينش بود * با جهاني فرو عظمت شوكت و شان * نصرت قرين طالع و اقبال همعنان *

'Ālamgīrnāma, Bibl. Ind. Text, 43, ll. 20-22.

With all his austerity and 'puritanism,' Aurangzeb was not free from superstition, and it would seem as if he had come to look upon this city as associated in no uncertain manner with the rise and culmination of his greatness.[2] It is,

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[1] So Khāfī Khān speaks of the Dekkan as "a mine of wealth and fighting material" (معدن خزائن و سپاه) *Bibl. Ind.* Text, II, 852.

Mr. Lane Poole writes: "The Deccan was the Dauphiné of the Moghul empire. It was there that Shah Jahan had mustered his strength to try conclusions with his father; and it was thence that Aurangzeb drew his forces in the struggle which ended in his coronation." 'History of India,' Ed. A. V. Williams Jackson, Vol. IV, 105-6.

[2] So Jahāngīr says: "My revered father considering the village of Sikrī, which was the place of my birth, *lucky for him* [برخورد مبارک دانسته

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perhaps, not altogether devoid of significance that he had, in 1100 A.H., just completed that conquest of the kingdoms of Bijāpūr and Gulkanda which had been the greatest ambition of his life. The cycle of good fortune which had begun with the foundation of the city had been thus completed, just at the time when the Dekkan bade fair to, once more, become his headquarters. There is, therefore, nothing surprising in his having commemorated the consummation of his plans by bestowing on the city associated with their inception and perhaps also, maturity the distinctive title '*Khujista-buniyād.*'

دار الامان 'House of peace, safety, security' is prefixed to the name of Āgra on the copper coins of Humāyūn. دار الامان آگرہ is never found in Abūl Faẓl *or* Badāonī, though it does occur once in the *Ṭabaqāt-i-Akbarī.* But nothing is said as to the reason of the epithet, and we are left only to speculation in the matter. The sole explanation I can offer is based on the following considerations.

The first year of the sixteenth century had seen the Uzbeg leader Shaibānī Khān pouring the destructive inundation of his barbarians over Transoxiana. Bukhārā and Samarqand soon fell before him. Shāhrukhia and Beshkent were ravaged. Khwārīzm was next attacked, and Balkh besieged and taken. All the horrors of Tātār warfare were afterwards let loose on the fair cities of Khurāsān. The Persians under Shāh Isma'īl then came upon the scene, and Shaibānī was defeated and killed in a great battle near Marv in 1510 A.C. His body was dismembered, the skin of his head was stuffed with hay and sent to the Emperor of Constantinople. "The skull set in gold, was made into a drinking cup, which the Shāh was proud of displaying at his great entertainments." (Erskine, 'History of Bāber and Humāyun,' I, 304.) The

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in the original], made it his capital," *Tūzuk-i-Jahāngīrī*, Rogers and Beveridge, Trans. I, 2. Elsewhere he informs us that Pānīpat "used to be very propitious to my gracious father and honoured ancestors and two great victories had been gained in it." *Ibid.*, I, 58.

این منزل و مقام بر آبای کرام و اجداد ذوی الاحترام ما همیشه مبارک و فرخنده آمده و دو فتح عظیم درین سر زمین رو داده *

Sayyad Aḥmad Khān's Edition, 27, l. 20.

In another place he writes: "Mu'taqid Khān bought a house at Āgra, and passed some days in that place. Misfortunes happened to him one after another. We have heard that prosperity and bad luck depend on four things; first, upon your wife, second, upon your slave; third, upon your house; fourth, upon your horse. *Ibid.*, I, 235.

So Mīr Ma'ṣūm informs us that his ancestor "Baba Hasan Abdāl settled at Langur of Kandahar, saying to his disciples, 'From this earth the smell of friendship comes to me.' He remained there all his days and died there." *Tarīkh-i-Sind*, Trans. Malet, p. 90.

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Uzbegs had gone, but the terrors of religious persecution were now added to the miseries of foreign invasion. "The Shāh's first care was to introduce the observances of the Shia sect into his new dominions; and, as he was met by a bigotry and a firmness equal to his own, he did not accomplish that object without a severe and cruel persecution, in the course of which the blood of many men eminent for their piety and their virtues flowed, and many distinguished names were added to the list of the martyrs for the pure Sunni faith." (*Ibid.*, I, 305). The Shāh commanded prayers to be recited and the Khuṭba read in Shī'a form in the grand mosque of Herāt. "The chief preacher of the mosque having honestly refused to repeat the curses on the three companions of the Prophet and Aisha, the Prophet's wife, was dragged from the pulpit, and cut in pieces on the spot. Next day, the Shāh sent for the Sheikh-ul-Islām, ... and attempted to bring him over to the new opinions. Having failed, the venerable man was condemned to a cruel death, in inflicting which the Shah himself is reported to have taken an active part. This persecution raged against recusants of every rank, as long as Shah Ismail remained in Khorāsān." (*Ibid.*, I, 321.) On the Shāh's death, the Uzbegs again invaded Khurāsān, took the holy city of Mashhad after a sharp resistance, and retaliated by putting all the male inhabitants of Ṭūs to the sword and carrying off all the women into slavery contrary to the terms of the capitulation. (*Ibid.*, I, 457.)

In these circumstances, many eminent men of both sects naturally sought safety in flight and several had taken refuge in the Court of Bābur. Abūl Faẓl gives the names of thirteen "illustrious men"—poets, divines, physicians and historians—who were his "courtiers and companions." Beveridge, *Akbar nāma*, Trans. I, 280-282.

With all his faults, Humāyūn was a man of learning and liberal sentiments. His father's marked predilection for knowledge and culture had descended to him. "He continued," says Noer, "the traditions of his house and loved even in the midst of all his troubles to be surrounded by poets, scholars and authors. It is the opinion of Nizāmu-d-dīn Aḥmad that he was unequalled as an astronomer and mathematician; he possessed also wide geographical information" (Noer, 'The Emperor Akbar,' Trans. Mrs. Beveridge, I. 136.) He was a poet besides, and we have the authority of Abūl Faẓl for saying that a copy of his complete *Dīvān* existed in the Imperial Library. (Beveridge, Tr. *Akbarnāma*, I, 665 and *Addenda*, p. xxix.) He was no bigot in religion, and Firishta informs us that he was "believed to be of the Shi'a persuasion, because *he gave such encouragement to Kuzilbashies and the inhabitants of Eerak to join his standard from his earliest years*, so that many persons of eminence in Khorassan, devotees of

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the Holy Family, found favour with him." (Briggs' Translation, Reprint, II, 179.) His court had thus become, as it were, a دارالامان, "the gathering-place of all men of worth and intelligence from adjacent countries and afforded *an asylum denied by their wild confusion and desolating unrest*, for the fostering and development of science." (Noer, *Op. cit.*, I, 126).[1] In this connection, the following passage from 'Abdu-r-Razzāq's *Maṭla'u-s-Sa'adain* is instructive and will bear quotation:

"Professors of various religions, and even infidels, abound in that city [*scil.* Hormuz], and no measure of injustice is permitted to any one in it; hence the city is called the abode of security (*dāru-l-amān.*)" (Elliot and Dowson, History of India, IV, 96. See also R. H. Major, *India in the Fifteenth Century*, Hakluyt Society, p. 7).

The epithet again attracts attention on the Multān Rupees of the very first year of Aurangzeb's reign. (1069 A.H.) After hurriedly going through the ceremonies of his first coronation at Dehlī, the Emperor took up the pursuit of Dārā, who had been forced to quit Lāhor, and taken the road of Multān. "On this Aurangzeb, who had already crossed the Satlaj, altered his course for Multān. Before he reached that city, he heard that Dārā had proceeded on his flight .... He therefore gave up his march to the westward, and returned without delay to Delhi." (Elphinstone, ed. Cowell, 605.) Aurangzeb left Dehlī on 7th Ẓīlqa'ada 1068 (*'Alamgīr-nāma*, 160), crossed the Satlaj on the 5th of Ẓīlḥajja (*Ibid.*, 192), was within three koss of Multān on the banks of the Rāvī on 7th Muḥarram, 1069 A.H. (*Ib.*, 207), and paid a visit

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[1] The most eminent of these literary refugees was the historian Khwandmīr, who has himself given a long account of the "annoyances and misfortunes to which he was subjected under Uzbeg rule in Herāt." (A. S. Beveridge, Memoirs of Bābur, 605 Note. See also Elliot and Dowson, IV, 142-3.) He paid his respects to Bābur on Saturday, the 4th of Muḥarram, 935 A.H., at Āgra (E.D., IV, 143) and his *Ḥabību-s-Siyar* was finished in Bābur's Camp at Tirmohanī near the confluence of the Sarjū and the Ganges. (Bombay Lithograph, I, iv, 84; E.D., IV, 155, 6.) He afterwards wrote the *Humāyūn-nāma* or *Qānūn-i-Humāyūnī*, accompanied Humāyūn to Gujarāt and died in his camp in 942 A.H.) (Beale, Oriental Biographical Dictionary, ed. Keene, *s.n.*; E.D., V, 116., Two other *emigrés*—Maulāna Shihāb, the Enigmatist, and Mīr Ibrāhim, the Harper, are also mentioned. A. S. Beveridge, *Loc. cit.*, 605; Badāonī, Ranking's Translation, I, 449-50. A later refugee was Mir 'Abdu-l-Laṭīf Qazvīnī. Suspected of leaning towards the Sunnīs, he and his father Mir Yaḥyā were persecuted by the bigot Shāh Ṭahmāsp. The father being too old and infirm to fly," died in prison at Ispahān. The son "fled to Gīlān, and afterwards at the invitation of the Emperor Humāyūn went to Hindustān." (Blochmann. *Ain*, Trans. I. 447-8). Of this man, Abūl Faẓl says that "from his lack of bigotry and his broad-mindedness, he was called in India a Shīa and in Persia a Sunnī." (Akbarnāma, Trans. Beveridge, II. 35). He was appointed tutor to Akbar in the second year (964-5 A.H.), and it was he who first taught Akbar the principle of the *Ṣulh-i-Kul* or 'Universal Toleration.'

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to the shrine of the Saint Bahāuddīn in the city on the 9th (*Ib.*, 209). In the '*Ālamgīrnāma*, the epithet *occurs for the first time* in the heading of the chapter describing the "Return of the victorious retinue from the *Dāru-l-amān* of Multān to the *Dāru-s-Salṭanat* of Lāhor and the march thence to the *Dāru-l-khilāfat* of Shāhjahānābād" (p. 211). It is quite possible that Aurangzeb coined the epithet as a memento of the sense of security he experienced on hearing of Dārā's flight from Multān to Bhakkar. "He had been travelling," writes Mr. Lane Poole, "by forced marches day and night, with his usual unflagging energy, lived the life of a common soldier, ate nothing but meal, drank bad water, and slept on the bare ground. His endurance of hardships awed his followers; but Dārā's own fatal tendency to political suicide saved his brother further trouble. The misguided prince, when aware of Aurangzeb's pursuit, instead of seeking to build up a formidable resistance at Kābul, where he was sure of the support of the governor, Mahābat Khān, turned south to Sind. Aurangzeb at once saw that the enemy had practically disarmed himself, and leaving a few thousand horse to keep up the chase, he returned to the east." (Aurangzeb, *Rulers of India Series*, 55-6.) Briefly, we may fairly suppose the title to have been conferred upon the city in grateful recognition of the *peace* and *tranquility* he had himself experienced in its neighbourhood. There was now no reason for anxiety, his most dangerous enemy had, instead of doing the thing he feared, done that which he hoped and wished, but never expected he would, and his throne was practically secure.

Such an explanation of the honorific is, at first sight, not unsatisfactory, but there are two fairly well-attested facts in the history of the town which appear to militate against it. In Multān are buried two of the most renowned saints of Musalmān India—Shaikh Bahāu-l-ḥaqq wau-d-dīn Zakarrīya and his grandson, Shaikh Ruknu-d-dīn. Of the first of these personages, it is said that when a Mongol force "descended on the province and dismantled the walls of the city," the citizens were saved from a general massacre by a ransom paid by him. (Imp. Gaz., XVIII, 26.) The sum is said to have been 100,000 Dināars. (Raverty, *Ṭabaqāṭ-ī-Nāṣirī*, Trans. 1201 note; see also 784, 844 and 845 *n*). This appears to have occurred about 653-4 A.H., 1257 A.C., and the saint is believed to have died on 7th Ṣafar 665 A.H., 7th November, 1266 A.C. (Jarrett, *Āīn*, III, 363; Beale, *Biographical Dictionary*, *s.n.*).

His grandson, Ruknu-d-dīn, is reported to have rendered the people of Multān a similar service in the following century. When Bahrām Ibā, the adopted brother of the Sulṭān Tughlaq, raised a rebellion in Multān, the Emperor Muḥammad marched against him, and he was defeated and put to death. "His head," says Badāonī, "was brought to the Sulṭān, who in-

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tended to set the blood of the Multānīs flowing like rivers on account of his crime, but when the Shaikhu-l-Islām Quṭbu-l-'Ālam Shaikh Ruknu-l-Haqq wau-d-dīn Quraishī....having bared his venerable head, presented himself at the court of the Sulṭān and made intercession, the Sulṭān pardoned the offences of the people." (Ranking's Translation. I, 304.) Firishta also tells us that "the king then gave orders for a general massacre of the inhabitants of Mooltan, but the learned sheikh Rookn-ood-Deen interceded for them, and prevented the effects of this cruel mandate." (Briggs, *Rise of the Mahommedan Power*, Calcutta Reprint, I, 421.)

Briefly, the city would seem to have twice received quarter (امان, quarter, pardon, indemnity, grace) through the intercession of these Saints, and might have been called دارالامان in consequence. The difficulty is that there is no trace of this particular epithet in historical literature before the time of Aurangzeb.[1] It is found in the *'Ālamgīrnāma* and occurs also in the *Maāsir-i-'Ālamgīrī*, though not in Khāfī Khān. There is no example of its use, however, in any earlier writer, though Firishta speaks of Multān as قبۂ الاسلام, 'The Cupola of Islām,' in an untranslated chapter of his History. (Lakhnau Lithograph, II, 404, l. 17).

It may be also not unworthy of notice that Multān is called بلدۂ طیبہ 'Excellent City' in the *'Ālamgīrnāma*, (210, 217) and شہر کرامت بہر (*Ibid.*, 209). کرامت is "a miracle performed by *holy men* as opposed to معجزۂ, a miracle wrought by God through His *Prophets* in proof of their mission." (*Hughes, Dictionary of Islam, s.v.*) "It is generally believed among the Mahammedans," writers Dr. Lee, "that every saint has it in his power to perform miracles without laying claim to the office of a prophet." 'Travels of Ibn Batuta.' Trans. 1829, p. 7 note.

During the dissolution of the Mughal Empire, the title دارالامان is prefixed to the name of Jammūn on the coins of the Dogra prince Ranjīt Dev. It looks at first sight, like a pretentious or meaningless transference by the Hindū chief

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[1] In a Farmān said to have been issued by Akbar in the 37th year of his reign, granting to Hir Vijaya Sūrī, tho Jain places of pilgrimage at Girnār, Ābū, Pārasnāth, etc. دارالامان ملتان-دارالسلطنت لاهور - دارالخلافت اکبر آباد and دارالخیر اجمیر are all distinctly mentioned, but the document itself is, on several grounds, open to suspicion. The Farmān has been published with a photographic facsimile and translations into English and Hindi by Munī Jīnavijayajī in the Introduction to a Sanskrit poem on Akbar called *Kripārasa Kosh.* (*loc. cit.* pp. 35, 40).

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of the title borne by Multān to his own capital. There are, it must be said, several other examples of the annexation by the rebellious vassals of the empire of the epithets, originally devised with some show of reason, by the Musalmān Pādishāhs. Thus Sindhia pleased himself with calling Mandisor دارالسلام. The Rāthor of Jodhpūr laid hands upon دارالمنصور. Some Daulatābād rupees struck, apparently, by the Mahrāttās bear the incongruous prefix Dāru-l-*Khilāfat* and the person in authority at Nāgor (or Nāgpūr) took a fancy to دارالبرکات, an old epithet of Ajmer.

It is true that Rodgers was of a different opinion. His remark that *Dāru-l-Āmān-i Multān* was given "more because of the rhyme than the reason" provokes the obvious comment that *Dāru-l-Amān-i*-Jammūn seems to have neither 'rhyme nor reason.' Our knowledge of the political history of Jammūn is really very small, but he seems to have felt no difficulty in accepting an explanation which he had come across in the Urdū History of the Panjāb, written by Rāi Kanhiyā Lāl Bahādur. "He says" writes Rodgers, "that in those days Jammū was regarded as the abode of peace and safety, that bankers and merchants had fled from the Sikh-spoiled plains of the Panjāb, and had taken refuge in Jammū where Ranjīt Deo was too strong for the Sikhs to attempt anything against him." (J.A.S.B., 1885, p. 62.) Once more, he assures us that "the time in which he [*scil.* Ranjīt Deo] lived was one of utter lawlessness, yet his little state was the *abode of peace and safety* (دارالامان)." *Ibid.* 63. Lastly, he asks his readers to notice "how the title of '*Dār-ul-Amān*,' the '*Gate of Safety*' agrees with the description of its condition under Ranjit Deo as given above by Rāi Kanhīyā Lāl. (*Ibid.*, 64.)

This Urdu work was, according to Rodgers himself, written only in 1877 A.C., and this explanation would appear, so far, to be unsupported by contemporary or other evidence of a reliable kind. But I find that the statement really rests on much better authority than Rāi Kanhyā Lāl's. Forster who passed through Jammu about April 1783, writes: "Runzeed Deve, the father of the present chief of Jumbo, who deservedly acquired the character of a just and wise ruler, largely contributed to the wealth and importance of Jumbo. Perceiving the benefits which would arise from the residence of Mahometan merchants, he held out to them many encouragements and observed towards them a disinterested and honourable conduct. Negative virtues only are expected from an Asiatic despot; * * * but the chief of Jumbo went further than the forbearance of injuries; he avowedly protected and indulged his people, particularly the Mahometans,

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to whom he allotted a certain quarter of the town, * * * and that no reserve might appear in his treatment of them, a mosque was erected in the new Colony; a liberality of disposition the more conspicuous, and conferring the greater honour on his memory, as it is the only instance of the like toleration in this part of India. * * * He was so desirous also of acquiring their confidence and esteem, that when he has been riding through their quarter during the time of prayer, he never failed to stop his horse until the priest had concluded his ritual exclamations. The Hindoos once complained to this Chief that the public wells of the town were defiled by the vessels of the Mahometans, and desired that they might be restricted to the water of the river, but he abruptly dismissed the complaint, saying that water was a pure element, designed for the general use of mankind, and could not be polluted by the touch of any class of people. An administration so munificent and judicious, at the same time that it enforced the respect of his own subjects made Jumbo a place of extensive commercial resort, where all descriptions of men experienced in their persons and property, a full security." George Forster, 'A Journey from Bengal to England.' Ed. 1798, I, 245–7.

This extract cannot be commended for brevity, but nothing could give a more vivid idea of the Oriental conception of a *Daru-l-Amān* than this European traveller's picturesque description of this Dogra prince's broad-minded tolerance. Indeed, we have here an elaborate paraphrase of the single sentence in which 'Abdu-r-Razzāq explains why Hormuz was honoured with the same appellation in his own day.

Cunningham also in his 'History of the Sikhs' has something to say about the matter.

"Harī Sing Bhangī died, and he was succeeded by Jhanda Singh, who carried the power of the Misal to its height. [He says this took place about 1770]. He rendered Jammu tributary, and the place was then of considerable importance, for the repeated Afghan invasions, and the continued insurrections of the Sikhs, had driven the transit trade of the plains to the circuitous but safe route of the hills; and the character of the Rājpūt chief Ranjit Dev, was such as gave confidence to traders, and induced them to flock to his capital for protection." (*Op. Cit.* Ed. Garrett. 114).

It remains to add that after Ranjit Dev's death, Jammū ceased to be 'a place of safety' or 'security.' Dr. Vogel writes: "Jammu was first invaded by Bhamma Singh in 1761, and Hari Singh in 1762, both of the Bhangi Misl, and the capital was plundered. The Sikhs were however compelled to retire before a fresh invasion of the Afghans under Ahmad Shah in 1764, and for twelve years there was peace. The second inroad was invited in 1774 by dissensions in the Jammu royal family.

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Ranjit Dev, was at variance with his elder son, Brajrāj Dev, and wanted to pass him over in the succession. * * * In the struggle which ensued, no decisive success was secured by either side and the Sikhs ultimately withdrew. * * * The next inroad occurred in 1782 under Maha Singh Sukarchakiá, the father of Ranjit Singh. By this time Ranjit Dev was dead. * * * The city of Jammu was plundered and burnt and the country laid waste, and this was followed by a dreadful famine which caused much distress." ('The Panjāb Hill States' in Journal of the Panjāb Historical Society, (1914), Vol. III, 117-8.).

The problem of these coins of Ranjīt Dev is not an easy one. Neither the date of his accession to the throne, nor that of his death is accurately known. According to the circumstantial account in Major G. Carmichael Smyth's 'History of the Reigning Family of Lahore with some account of the Jummoo Rājās' (quoted by Rodgers), he was born in 1724, ascended the throne in 1742 and reigned 'in peace and prosperity till 1780 A.D. when he died.' (*Ibid.*, 65.) The difficulty is that we possess coins struck in Ranjīt Dev's name in *Samvat* 1841 (26 R.), *i.e.* 1784-5 A.C. Some other coins issued from *Dāru-l-Amān-i*-Jammūn in the name of Shāh 'Ālam II are dated 1195 (XXIII R.), 1196 (XXIV R.) and 1197 (XXV R.), *i.e.* 1781, 1782 and 1783 A.C.

Forster says that Ranjīt Dev died in 1770.

"It appears," he writes, "that Jumbo continued to increase in power and commerce until *the year* 1770, *the period of Runzeid Deve's death*, when one of his sons, the present chief, contrary to the intention and express will of his father, seized on the government, put to death one of his brothers, the intended successor, and imprisoned another; who having made his escape sought the protection of the Sicques." (*Op. cit*, I, 247-8.)

The compiler of the article on Siālkot on the 'Imperial Gazetteer' asserts that Ranjit Dev died in 1773 A.C. (*Op. Cit.* XXII, 328). Cunningham declares that the event occurred in 1770. ('History of the Sikhs,' Ed. Garrett, 1918, p. 115 note). Dr. Vogel, who has recently devoted considerable attention to the history of the Panjāb Hill States and had the advantage of examining their archives, implies that Ranjit Dev was alive in 1774, and died only in 1781. "Amrit Pāl reasserted the claim of Basohlī, and with the help of Ranjīt Dev of Jammu seized the territory in 1774. On the death of Ranjīt Dev in 1781, his son and successor, acting as lord paramount, restored these *Parganas* [*Scil.* Bhalai and Jundh] to Chamba. * * *. The Tānkarī letter from Brajrāj Dev conveying the territory to Chamba is still extant, and is dated 15th Bhadon, S. 57 (A.D. 1781). In another Tānkarī document from the same source, dated 18th Bhadon, S. 59 (A.D. 1783), we find the same statement." 'History of Basohli State in Journal. Panjāb

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Historical Society, Vol. IV, 1915, p. 94. (See also *Ibid.*, p. 44)

It is obvious that there is a mistake or confusion somewhere. If the coins were struck by Ranjīt Dev himself, these dates must be wrong. If the dates are correct, the coins must have really been issued by some one else in his name after his death.

دارالبرکات 'Abode of blessings or prosperity' is coupled with a mint-name of which it is not easy to say whether it is Nāgor or Nāgpūr. I am personally inclined to prefer the former reading for the following reason. Dr. White King had a *Dārul-Mansūr-i*-Jodhpūr rupee of the fourth year of 'Ālamgīr II. There is in the Panjāb Museum a *Dārul-Barakāt-i-Nāg-r* rupee of the fifth year of the same Emperor. Both coins have been figured, the Jodhpūr coin in Num. Chron. 1896, Pt. ii, Pl. xii, fig. 8, the *Dāru-l-Barakāt* rupee in P.M.C., Pl. XVII, No. 2839. It seems to me that there is a very close resemblance in the style of the lettering which is, by itself, of a somewhat peculiar type. The obverses, in particular, are so similar as to indicate that the dies of both were either cut by the same person or that the engraver of the second had the first before him as his model.

The history of Nāgor in the 18th century may possibly throw some light on the origin of the epithet. Tod writes: "Of the twelve sons of Ajeet [Ajīt Singh, Rāja of Jodhpūr], Abhe Sing and Bukht Sing were the two elder. . . . . To Bukht Sing, who was with his father, the eldest brother wrote, promising him the independent sovereignty of Nagore where they then were . . . . as the price of murdering their common sire. Not only was the wretch unstartled by the proposition, but he executed the deed with his own hands, under circumstances of unparalleled atrocity." ('Annals and Antiquities of Rajasthan,' Calcutta Reprint, 1898, I, 763.)

This was in Vikram Samvat 1781 (1724 A.C.). On coming to the throne, Abhay Singh not only fulfilled his promise to his brother, but added to it the fief of Jhālor. (*Ib*, I, 764.) After a reign of twenty-six years, Abhay was succeeded by his son Rām Singh in 1750 A.C. Bakht Sing "absented himself from the inauguration, and sent his nurse as his proxy. This was construed as an insult by Ram Singh who resumed the fief of Jhālor. "(*Ibid.*, II, 944.) A civil war broke out. Rām Singh was defeated at Mairta, and Bakht Singh became King of Jodhpūr "with the support of a great majority of the clans." (*Ibid.*, 946.) He ruled only for three years but during that short period, "he found both time and resources to strengthen and embellish the strongholds of Marwar. He completed the fortifications of the capital, and greatly added to the palace of Joda from the spoils of Ahmedabad. He retaliated the injuries on the intolerant Islamite, and *threw down*

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his shrines and his mosques in his own fief of Nagore, and with the wrecks restored the edifices of ancient days." (*Ibid.*, 948.) Bakht Singh was poisoned in S. 1809 (1752 A.C.) and succeeded by his son Bijai Singh. Meantime, the dispossessed Rām Singh had called in Jayāppā Sindia to his aid. Bijai was defeated on the plains of Merta in 1756 and obliged to take refuge in his father's old fief of Nāgor. "During six months, he defended himself gallantly in Nagore, against which the desultory Mahrattas, ... made no impression." (*Ibid.*, 774.) While the siege was dragging on, "a Rajput and an Afghan . . . . offered . . . . to sacrifice themselves for his safety, by the assassination of the Mahrattā commander." Jayāppā was murdered at the door of his tent; one of the assassins "plunged his dagger in his side, exclaiming 'this for Nagore!' and 'this for Jodhpur!' said his companion, as he repeated the mortal blow." (*Ibid.*, 776-7.) By this murder, the hordes of Jayāppā were converted "from auxiliaries into principals in the contest," and were appeased only by the cession of Ajmer and a fixed triennial tribute. But they at the same time "displayed the virtue common to such mercenary allies, and abandoned Rām Singh to his evil star." Bijai Singh himself reigned in peace for several years. (*Ibid.*, 953.)

It may be fairly conjectured that the epithets دارالبرکات and دارالمنصور are connected with these events. Nāgor was inseparably associated with the rise of Bakht Singh's fortunes and Jodhpūr with their culmination. Both towns were Bijai Singh's towers of strength also and remained faithful to him. This is perhaps the reason of their being entitled 'Abodes of blessing' and 'Abodes of victory' on the coins.

دارالجهاد 'Seat or Land or Country of Holy War' makes it first appearance on the coins in 1099 A.H. There is no room for doubt as to the reason of the epithet. "When Aurangzeb drew near to Haidarabad," Khafī Khān informs us, "Abūl-Hasan. . .sent a letter to Aurangzeb, renewing his protestations of obedience. and reiterating his claims to forgiveness. . . . Aurangzeb wrote a reply, the gist of which is as follows: 'The evil deeds of this wicked man pass beyond the bounds of writing; but by mentioning one out of a hundred, and a little out of much, some conception of them may be formed. First, placing the reins of authority and government in the hands of vile tyrannical infidels; oppressing and afflicting the saiyids, shaikhs and other holy men; openly giving himself up to excessive debauchery and depravity; indulging in wickedness and drunkenness night and day; making no distinction between infidelity and Islām, tyranny and justice, depravity and devotion, waging obstinate war in defence of infidels; want of obedience to the Divine Commands and prohibitions, especially to that command which

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forbids assistance to an enemy's country, the disregarding of which had cast a censure upon the Holy Book in the sight both of God and Man..... Moreover, it had lately become known that a lac of pagodas had been sent to the wicked Sambhā.'" (E.D. VII, 325; Text II, 327-8). The same writer subsequently tells us that after the conquest, "the city was called the hostile country (*dāru-l-jihād*)" (*Ibid.*, 336), and that 'Abdu-r-Raḥīm Khān was appointed Muḥtasib or censor. "It was ordered that several customs of the infidels and other innovations which the irreligious (or heretical) Abūl Ḥasan had introduced should be set aside, and that the idol-temples should be demolished and mosques erected in their stead." [1]

فرمودند که بعضی رسم کفار و بدعتهای دیگر که ابوالحسن بیدین رواج
داده از شمر بر طرف سازند و بتخانها را مسمار نموده مسجد نمایند *

Bibl. Ind., Text II, 358-9.

Among the passages in the Qur'ān in which *Jihād* is enjoined (Sūra II, 214-5; IV, 76-9; VIII, 39-42; IX, 5-6; IX, 29), the persons against whom it is a duty to declare it are most clearly indicated in the last, which runs thus: "Make war [جهاد] upon such of those to whom the Scriptures have been given as believe not in God, or in the last day, and *who forbid not that which God and His Apostle have forbidden*, and who profess not the profession of the Truth."

The head and front of Abū-l-Ḥasan's offending had been the assistance given to the *dāru-l-ḥarbī* Shambhājī and "want of obedience to the divine commands and prohibitions." The first thing Aurangźeb did after the conquest was to give orders for the setting aside of "several infidel customs and other innovations which the irreligious (or heretical) Abū-l-Ḥasan had introduced." Now, what were these customs? Tavernier, Thevenot and Manucci have left us some word-pictures of Ḥaidarābād which enable us to understand the reasons of Aurangzeb's denunciation.

"There are," says the first of these travellers, "so many public women in the town, the suburbs and in the fortress, which is like another town, that it is estimated that there are generally more than 20,000 entered in the Darogha's register, without which it is not allowed to any woman to ply this trade. .... In the cool of the evening, you see them before the doors of their houses. .... It is then also that the shops

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[1] The orders were evidently executed.
"At Maisarām, 10 miles south of Hyderābād, are the remains of some Hindu temples destroyed by Aurangzeb after the fall of Golconda." 'Imperial Gazetteer,' Ed. 1908, VI, 126.

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where they sell *tāri* [toddy] are opened. .... The king derives from the tax which he places on the *tāri* a very considerable revenue, and it is principally on this account that they allow so many public women, because they are the cause of the consumption of much *tāri*, those who sell it having for this reason, their shops in their neighbourhood. These women have so much suppleness and are so agile that when the king who reigns at present wished to visit Masulipatam, nine of them very cleverly represented the form of an elephant, four making the four feet, four others the body, and one the trunk, and the king mounted above on a kind of throne, in that way made his entry into the town." ('Travels,' ed. Ball, I, 157-8).[1]

"Publick Women," says Thevenot, "are allowed in the kingdom, so that nobody minds it when they see a man to their Houses and they are often at their Doors well-drest, to draw in Passengers; But they say, most of them are spoiled. The common People give their Wives great Liberty: When a Man is to be Married, the Father and Mother of his Bride, make him promise that he will not take it ill, that his Wife go and walk through the Town, or visit her Neighbours, nay and drink Tary, a drink that the Indians of Golconda are extreamly fond of." ('Travels into the Levant.' Eng. Trans. of 1687, Pt. III, p. 97.)

Manucci tells a story (which is too long to quote in his own words), of a Musalmān from Persia who on being wantonly insulted by a Hindu, gave him a slap. The Hindūs then gathered in great numbers, beat him, bound him and carried him to Mādanā, Abū l-Ḥasan's Brahmin minister. The minister ordered the hand with which the blow had been given to be cut off. The Musalmān fried the severed hand in oil, showed it to Aurangzeb, and cried out that God had made him king "to redress injustice, such as this done to a Sayyid, a descendant of the Prophet..... He was told to be patient, and in due time punishment would be inflicted, for the little respect paid by the tyrant to the chosen of God." Irvine, 'Storia do Mogor,' Trans. III, 131-2.

The following dicta from the 'Fatāwā-i-'Ālamgīrī,' a

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[1] This is borne out by what Khāfī Khān says, Elliot and Dowson, VII, 336. "He [Muhammad Qulī Quṭb Shāh, King of Gulkanda] took great pains in repairing the fort of Golkonda. He had a wife named Bhāgmatī, of whom he was very fond. At her request, he built a city two *kos* distant from the fortress, to which he gave the name of Bhāgnagar. Some time after the death of Bhāgmati, the name was changed to Haidarabad: but in the vernacular language of the people it is still called Bhāgnagar. That woman had established many brothels and drinking shops in that place, and the rulers had always been addicted to pleasure and to all sorts of debaucherry. Abū-l-Ḥasan exceeded all his predecessors in his devotion to pleasure. So the city got an evil name for licentiousness. After the conquest by Aurangzeb, it was called the hostile country (*dāru-l-jihād*)."

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work on Sunnī jurisprudence, composed by a syndicate of scholars under the instructions of Aurangzeb himself are of interest. "A *Dāru-l-ḥarb* becomes a *Dāru-l-Islām* on one condition, namely, the promulgation of the edicts of Islām. The Imām Muḥammad in his book, called the *Ziyādah*, says a *Dāru-l-Islām* again becomes a *Daru-l-ḥarb*, according to Abū Ḥanīfah on three conditions, namely (1) that the edicts of the unbelievers be promulgated, and the edicts of Islām be suppressed; (2) that the country in question be adjoining a *Dāru-l-ḥarb* and no other Muslim country lie between them, that is, *when the duty of Jihād or religious war becomes incumbent on them, and they have not the power to carry it on*; (3) that no protection (*amān*) remains for either a Muslim or a *zimmī*, viz. that *amānu-l-awwal*, or that first protection which was given to them when the country was first conquered by Islām." *Fatāwā-i-'Ālamgīrī*, Vol. II, p. 854, quoted in Hughes' 'Dictionary of Islam,' p. 69. See also Houtsma, 'Encyclopaedia of Islam,' S. V. *Dāral-Harb*.

دارالخلافت, 'Seat of the Khilāfat (Caliphate)' One of the strangest things about the issues of the first period of Akbar's reign is that this epithet is indiscriminately associated with the names of no less than thirteen mints, Aḥmadābād, Akbarpūr-Tānda, Āgra, Awadh, Bahrāīch, Jaunpūr, Dogāon, Shāhgarh-Qanauj, Gwāliar, Gorakpūr, Lāhor, Lakhnau, and Mālpūr (?). It is not easy to understand why so many places of, at best, but second or third-rate importance were given such an exalted appellation. There is something of the same confusion in the historians of the period. Āgra, Dehlī, Fatḥpūr and Lāhor are all promiscuously called *Dāru-l- Khilāfat*, and at the same time have other epithets of similar import, but it is not carried to anything like the same length. Moreover, all those four towns were or had been metropolitan centres in the real sense, at some time during the reign. It is not easy to suggest an explanation, and I can only cite a passage in the *Akbarnāma* which appears to have some bearing on the matter. Writing of Humāyūn's 'Return and Restoration,' Abūl Faẓl says:—

"As the affairs of the Panjāb had been happily arranged by the expedition of His Majesty the Shāhinshāh [*i.e.* the Prince Akbar] there, His Majesty Jahānbānī [*scil.* Humāyūn] remained in Dehlī, and employed himself in the work of political administration. He gave his attention to the reconstruction of the territories, the extirpation of enemies and the conquest of other provinces. He repeatedly said that he would *make several seats of government*, and labour for the regulation of India. *Dehlī, Āgra, Jaunpūr, Māndū, Lāhore, Qanauj and other suitable places* would be chosen and in every place there would be an army under the charge of a prudent, far-seeing, subject-cherishing and just officer, so that there should be no

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need for an auxiliary force. And he would not keep more than 12,000 horse attached to his own person." (Beveridge, *Akbarnāma*, Trans. I, 642 ; Bibl. Ind. Text I, 356.)

The unhappy accident which befell him soon after his restoration put an end to this, and many other magnificent projects so far as he was concerned, but it is not impossible that the idea of having "several seats of government" [the word in the original is پای تخت] at "Dehlī, Āgra, Jaunpūr, Māndū, Lāhore, Qanauj and *other suitable places*" was seized with avidity by the highly receptive mind of his son who appears from the very first, to have been troubled, as Mr. Lane Poole puts it, with "a perpetual restless yearning after innovation." (B.M.C. Introd lxvi.)

It is true that after the introduction of the Ilāhī types, all these *Dāru-l-Khilāfats*, *Dāru-s-Salṭanats*, and the rest were swept off the board, and are rarely found on the coins before the accession of Shāh Jahān, but while they were in vogue, there appears to have been no small diversity and caprice in their application.

دارالخیر Abode of goodness, felicity, grace, is observed on the coins in conjunction with Ajmer about the thirtieth year of Aurangzeb's reign, but the epithet itself is really of much older origin, and is coupled with the name of town in the *Bādishāhnāma* of 'Abdu-l-Ḥamīd Lāhorī which appears to have been completed about the twentieth year of Shāh Jahān (Bibl. Ind. Text. I, pt. i. 165, 174).[1] Several other synonymous titles are bestowed upon the town by the historians, *e.g*

دار البرکت, Abode of blessing ;

خطّهٔ فیض اساس, District of gracious foundation ;

دارالسعادت, Abode of felicity or bliss ;

خطّهٔ مبارک, Blessed district, territory or place ;

in all of which there are clear allusions to the spiritual benefits accruing from pilgrimages to the tombs of Shaikh Mu'īnu-d-dīn Chishtī and other holy persons reposing there. The tomb of the former—the 'Khwāja of Ajmer,' as he is generally called—is spoken of as

روضهٔ قدسیه 'Ṭabaqāt-i-Akbarī' (Lakhnau Lith.), 291.

روضهٔ مقدّسه 'Badāonī,' II, 185.

مرقد متبرّکه 'Badāonī,' II, 49.

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1 "Muḥammad Ṣāliḥ in his '*Amal-i-Ṣālih* informs us that 'Abdul Ḥamīd was celebrated for the beauty of his style, and that he died in 1065 H. (1654 A.D.)." Elliot and Dowson, VII. 3.

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مرقد منوّر 'Ṭab. Akb.' 256 ; 'Badāonī,' II, 165.
مزار فایض الانوار 'Badāonī,' II, 108, 228 ; 'Ṭab. Akb.' 348.
مزار متبرک فایض الانوار 'Badāonī,' II, 165.

It is perhaps worth while to state that Kerbela (or Mashhad-i-Ḥusain), "a place of pilgrimage of the Shi'ite Moslems which is only less sacred to them than Mashhad-i-'Alī and Mekka," is called ارض الخیر on the coins of the 'Abbāsides. Codrington, 'Manual of Musalmān Numismatics,' 130.

دارالسرور 'Abode of delight or enjoyment or gladness' first attracts the attention of the numismatist on the Burhānpūr coins of Bahādur Shāh, Shāh 'Alam I, but the epithet was really given to the town by Shāh Jahān That Emperor had more than once chosen it for his residence when sent by his father to pacify and restore Mughal authority in the Dakhan, and it was again his headquarters when he proceeded to the south in person to quell the rebellion of Khān Jahān Lodī. The author of the *'Amal-i-Ṣāliḥ* or *Shāhjahān-nāma* informs us that the Emperor made his official entry mounted on an elephant on the 22nd of Isfandārmaz of the second year (1039 A.H.), at an auspicious moment carefully selected by the astrologers. He then proceeds thus :—

و آن خطهٔ پاک از ورود مسعود آبروی عالم آب و خاک آمده از یمن قدوم و فیض حضور آن حضرت دارالسرور خطاب یافت *

Bibl. Ind. Text 370, ll. 1-3.

"And that pure locality (*lit.* district) became the pride (*lit.* light of the countenance) of the world of land and water on account of his happy arrival, and obtained the title of *Dāru-s-Surūr* from the blessing of the steps and the beneficence of the presence of His Majesty."[1]

Shāh Jahān had moreover, built here a palace for himself in the days when he was prince, and the beauties of the gardens, and fountains and hunting-grounds of a suburb called

[1] Khāfī Khān has a similar statement, of which the source was probably the *Shāhjahānnāma-i-Deh-sāleh* of Mīrzā Amīna which he more than once refers to as his authority for the period (Text, I, 248).

و اوایل ماه جمادي الاخري داخل برهانپور گردیده آن شهر را بدارالسرور موسوم گردند *

(Bibl. Ind. Text, I, 424, ll. 20-21).

"And the Emperor [Shāh Jahān] entered Burhānpūr in the beginning of Jumādī the second [1039 A.H.) and [ordered] that city to be called *Dāru-s-surūr*."

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Karāra which had been mainly laid out in accordance with his taste and instructions are frequently enlarged upon by the Mughal historians. (*'Amal-i-Ṣālih*, 395; *Bādishāhnāma*, I, i, 331-2; I, ii, 134, 206; 'Khafī Khān,' I, 520, 538)

It is not perhaps generally known that Bahādur Shāh, Shāh 'Alam, I, had first seen the light of day at Burhānpūr, (*Bādishāhnāma*, II, 343; Beale, *Miftāḥu-t-Tawārīkh*, 297; Irvine, Manucci, 'Storia do Mogor,' IV. 245 n.), and he may be not unreasonably supposed to have entertained some partiality for the town on that account. However that might be, it is certain that he encamped there after defeating Kām Bakhsh.

Khāfī Khān informs us that the imperial tents were pitched in the environs of the *Dāru-s-Surūr-i-Burhānpūr* in Rajab [1121 A.H.], and that the Emperor had hopes of spending some time in pleasure and enjoyment, and hunting and roaming about *in the pleasances and waterfalls of the delightful abode of Karāra*, before devoting himself to the civil administration. But the Rājpūt troubles compelled him to leave his luxurious quarters in the beginning of Sha'abān [1121 A.H.]. Bibl. Ind. Text, II, 650.[1]

دارالسرور برهانپور occurs twice in the *Maāsir-i-'Alamgīrī* and more than a dozen times in Khāfī Khān. The historian Badāonī speaks of the دارالسرور پیشاور and also of دارالسرور فتحپور. The last collocation is found in the '*Ṭabaqāt-Akbari*' as well as in the *Bādishāhnāma* of 'Abdul Ḥamīd Lāhorī.

During the days in which the Mughal Empire was no more than a name, this honorific epithet appears on the *silver* coins of a different town—Sahāranpūr. These issues are most probably of Marāṭhā origin. The three rupees in the Panjāb Museum are of the 36th, 39th and 42nd years of Shāh 'Ālam II (1209, 1212 and 1215 A.H.) The copper coins in the same collection are of the 39th, 40th and 44th years. The copper coins registered in the I.M.C. are of the 33rd and 42nd years (1205 and 1215 A.H.). In his note on the mint, Mr. H. N. Wright says that the district of which Sahāranpūr was the principal town "had been acquired by Najīb Khān Rohīlla and remained in his family for two generations" (I.M.C. III,

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1 "Burhānpur is now one of the largest and best-built cities in the Deccan. ....The Moghal remains are, the Lāl Killa, or red fort, built by Akbar. Though much ruined, it has halls embellished with white marble, gardens, pleasure grounds, and other relics of imperial magnificence. Other Moghal remains are the *Ahu Khāna* or deer park on the south of the Tāpti and many small tombs and mosques. ....The Lāl Bāg, two miles north of the town, one of the old Musalmān pleasure-places, is kept in good order and used as a public garden. ....Under the Moghals, Burhānpur was plentifully supplied with water by a system of very skilful works. Eight sets of water-works can still be traced in the neighbourhood." 'Bombay Gazetteer,' Vol. XII (Khāndesh), 589–591.

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Introd. lxxv). But the coins under discussion belong to a somewhat later period. Najīb Khān's grandson, who was no other than the infamous Ghulām Qādir, was "mutilated and killed by Sindhiā in 1788; the country then fell into the hands of the Marāthās, and remained in their possession until the British conquest" in 1803-4, though their hold on it "was very precarious owing to the perpetual raids made by the Sikhs." ('Imp. Gaz.' XXI, 370.) [1]

"During the Augustan age of the Mughal Empire, Sahāranpūr was a favourite resort of the court and the nobles, who were attracted alike by the coolness of its climate and the facilities which it offered for sport. The famous Empress Nūr Maḥal had a palace in the village which still perpetuates her memory by the name of Nūrnagar, and under Shāh Jahān, the royal hunting-seat of Bādshāh-Mahal was erected by Alī Mardān Khan, the projector of the Eastern Jumna Canal" (*Ibid.*, , XXI, 369). There is still excellent sport to be had in the district. It is also "noted for the production of excellent fruit of European varieties" and the botanical gardens in the city are among the finest in the country. (*Ibid.*, 368.)

دارالسلام 'House of Peace' is in Arabic and Persian literature associated from very early times with the name of Baghdād. Mr. Amīr 'Alī informs us that the epithet "was derived from a prophecy made by the astronomer-royal Noubakht, that none of the caliphs would die within the walls of the city, and the strange fulfilment of this prognostication in the case of thirty-seven Caliphs." ('Life and Teachings of Mohammed,' ed. 1899, p. 543.) It is not easy to say why it was chosen for the distinctive mint-title of Dogāon (986 A.H.). There can be no doubt of Dogāon having been, at the time, a place of considerable commercial importance, and it could lay claim even then to a very respectable antiquity. In his informing article on the subject, Major Vost conjectures that Dogāon must have been founded in the thirteenth century. "As we are told," he writes, "that Nāṣiru-d-dīn [Maḥmūd] during his brilliant administration of this district made his power felt even in the hills and rendered Bahraich prosperous in the extreme, it is not improbable that it was under his auspices that this town was established." (J.S.A.B. 1895, p. 71.) The fact of the matter is that we possess very good evidence of its being much older. The great Arab polyhistor Alberūnī writes (c. 1030 A.C.) in the famous chapter of the *Taḥqīqu-l-Hind* containing the 'Itinera-

[1] "On the reduction of Meerut, Rana Khan (Sindhia's general), led his army to Sehaurunpore which place, on hearing the fate of Gholaum Caudir, submitted to the Marhatta authority, who from that time, have remained undisturbed masters of the whole province." Francklin, 'History of the Reign of Shaw Aulum,' ed. 1798, p. 184.

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ries of the distances between the several kingdoms' of the Hindūs : "Marching from Kanoj towards the east, you come to Bārī, 10 farsakh ; *Dūgum*, 45 farsakh ; the empire of (Shilahat, 10 farsakh ; the town Bihat, 12 farsakh. Farther on, the country to the right is called Tilwat [Tirhut]....Opposite Tilwat the country to the left is the realm of Naipāl." (Sachau's Translation, I, 201). See also Elliot and Dowson, I, 56-57.

But this does not explain why it was called *Dāru-s-salām*, and there is no trace of the epithet in the historical literature.

The prefix has been, by some authorities, read as دارالاسلام, but there is this to be said against the reading, that on most of the clearer specimens, only three *alifs* are discernible and not four. An immense proportion of the Sarkār of Bahrāich was, in Akbar's days, dense forest "with scattered settlements of Rajpūt clans here and there. It stretched far up into the Nepal Terāī and much of it was only nominally under Musalmān sway." (J. Beames, 'On the Geography of India in the Reign of Akbar, Subah Avadh,' J.A.S.B., 1884, p. 224.) Bahrāich, Dogāon and the other towns where Musalmān garrisons were permanently quartered, and where the imperial authority had been firmly established were thus دارالاسلام,[1] as opposed to the hinterland—into which Islām had not yet effectively penetrated, and where the infidels continued to hold their own (دارالحرب).[2] But then the epithet appears on the coins only about 986 A.H., when Akbar's faith in Islām itself had been seriously shaken, and he was hardly likely to parade it on his coins. Perhaps the initial *alif* of اسلام was cut off and the epithet altered to دارالسلام 'House of Peace, Tranquility or Universal Toleration' (صلح کل) for that very reason.

Some copper coins of Humāyūn bear the inscription دارالضرب خطّه متبرک جونپور The first half of the epithet stands in

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1 "*Dāru-l-Islām*, Abode of Islām, is a country where the ordinances of Islām are established and which is under the rule of a Muslim sovereign. Its inhabitants are Muslims and also non-Muslims who have submitted to Muslim control, and who under certain restrictions and without the possibility of full citizenship, are guaranteed their lives and property by the Muslim state." Houtsma, 'Encyclopaedia of Islām,' *s.v.*

So Badāoni writes that Sulaimān Kararānī the Ruler of Bengal had "captured that mine of heathenism," Katak-Banāras, and made Jagannāth a *Dāru-l-Islām*. Bibl. Ind. Text, II, 163. Lowe, Tr. II, 166.

2 So Badāonī speaks of the "دار الحرب of Goganda and Konbhalmer." Text, 228, l. 1; Lowe, Trans. II, 233). The people of Āssām are called کفار دارالحربی by Khāfī Khān. Text II, 133, l. 15. Shambhājī is کافر حربی. *Ibid.*, II, 391, l. 9, and Deccan itself is دارالحرب. *Ibid.*, II, 539. See also II, 255 and II, 328

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need of no explanation, but it is not easy to say why Jaunpūr is styled خطهٔ متبرک 'blessed district.' I can only suggest that the reference is to the men of piety and learning who have found their last resting-place in that city. Jaunpūr was, during the rule of the Sharqī dynasty, one of the greatest and most magnificent cities in India. We are informed that even after the decline of its political importance, "it retained its reputation as a seat of Muhammadan learning, which had gained for it the title of 'Shiraz of India." (Imp. Gaz. XIV, 83). Some of the finest specimens of "Pathān" architecture are to be found in Jaunpūr, which is strewed with the ruins of old Mosques and the mausoleums of famous theologians and doctors of the Law, Mystics or devotees, martyrs and confessors of Islam. According to Musalmān ideas, "the soil in which a saint reposes is holy" (Blochmann, Proceedings, A.S.B. 1874, p. 160). Bābur takes care to inform us that "Ghazni has many blessed tombs." (Memoirs, Trans. A. S. Beveridge, p. 218). The author of the Provincial History of Gujarāt, called *Mirāt-i-Aḥmadī*, devotes a long chapter to the "tombs [مزار] of the great men of the Faith who repose" in the towns of Aḥmadābād, Pattān-Nahrwāla, Broach, etc. (Bombay Lith., Part II. 15–85). It may be fairly conjectured that the honorific متبرک has reference to the numerous places of sepulture (مزار or زیارتگاه) which are described at length in the *Jaunpūrnāma* of Faqīr Khairu-d-dīn Muḥammad. (Elliot and Dowson. VIII, 237).

I may also add that the compiler of the *Maāṣiru-l-Umarā* speaks of the town in one place as دارالخیر جونپور—a collocation which at once puts one in mind of دارالخیر اجمیر (*Op. Cit.* I. 179, l. 11.)

دارالظفر 'Abode of victory or triumph' is found by itself or in juxtaposition with Bijāpūr in all the historians of the period after the conquest by Aurangzeb. The author of the *Maāṣir-i-'Ālamgīrī* expressly tells us that "Ruḥalla Khān received in the 30th year "orders to take charge of the administration and government of Bījāpūr which [now] became the equal of the principal ṣubas by the title of *Dāru-z-ẓafar*."

روح الله خان بخدمت نظم و نسق بیجاپور که بلقب دارالظفر با صوبجات

عهده همسر شده فرمان پذیر گردید *

Bib. Ind. Text, 282, ll. 8-9.

I do not know if it has struck others, but it has occurred to me that the epithet is really a sort of pun on the old name. Bījāpūr is really *Vijayapūra*, and would mean 'City of victory' in Sanskrit. *Dāru-z-ẓafar* signifies exactly the same in Arabic,

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and was, perhaps, deliberately coined for the purpose of proclaiming the victory of not only the *arms* of Islām, but also of the *language* of Islām over that of the Hindūs.

Orientals do not think so meanly of verbal ingenuities and conceits of this sort as Europeans of the 20th century, and there was a time when they were not uncommon in the literature of the most cultured *Western* nations. Persian and Arabic prose and poetry are full of them and a felicitous pun, acrostic or chronogram rarely fails to command admiration even now in the literary circles of the East. In the past, they have secured for their authors the companionship of great princes and sometimes honours, titles and great offices.

One of the many mint-titles of Āgra is دارالعدل, 'Abode of justice,' and the Emperor Humāyūn deserves the credit, such as it is, of having invented it. There is nothing peculiar or characteristic in the epithet itself. Even tyrants do not openly profess to be unjust, and every city in a well-governed kingdom is, or at least ought to be, the 'abode of justice.' Humāyūn was a shiftless and ineffective ruler, but he was at the same time inordinately vain and almost devoured by self-esteem. It seems as if the appellation was designed to commemorate some act or innovation of which he was proud. There is in the *Akbarnāma* of Abūl Faẓl, a description of a somewhat theatrical device for publicly demonstrating his love of justice which may have some bearing on the point. In the course of a chapter specially written for the purpose of giving an account of Humāyūn's 'Remarkable Inventions and Regulations,' that writer says: "Another of his inventions was the drum of justice. [طبل عدل]. If the claim of any one related to some dispute, he beat the drum once. If his grievance consisted in the non-receipt of stipend, or wages, he struck twice. If his goods and chattels (*māl-u-jihāt*) had been seized by oppression, or had been stolen, he complained by beating the drum thrice. If he had a claim of blood against any one, he beat the drum loudly four times." Beveridge, *Akbarnamah*, Trans. I, 651 (Text, I, 361).

The thing is mentioned also by the contemporary author, Khwāndmīr, who was in Humāyūn's court at the time, and has left behind a work entitled *Qānūn-i-Humāyūnī*. (*Ibid.*, 651 note and 645-50 notes.) Erskine, too, has referred to the matter, and it may be permissible to quote his remarks as they are not devoid of interest.

"The drum of justice was another of his institutions, borrowed from ancient tradition. A huge drum being placed near the imperial tent or pavilion, any one who suffered from injustice might claim redress by striking it according to certain rules, and the Emperor himself attended to the appeal. In early times, when law was very imperfectly and arbitrarily administered, and where complaints did not easily reach the ear

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of the despot, such an institution, rude as it is, or indeed any other professing to forward the means of redress, was commendable and might be useful. But its revival in a more advanced age betrays an extreme want of legislative skill; and it must be confessed that in this, as in many other of Humāyūn's regulations that have been noticed, there is a great want of plain practical sense, a pedantic application of inapplicable learning, and too great an appearance of playing at kings." ('History of Bāber and Humāyun,' II, 533-4.)

I may add that the drum of justice is associated in Oriental tradition with the name of the Sāssānian Emperor, Khusrū Anūshīrvān (Chosroes).

Jahāngīr takes great credit to himself in the 'Tūzuk,' for having revived in a slightly altered form, the 'institution' of his grandfather. "After my accession, the first order that I gave," he writes, "was for the fastening up of the Chain of Justice, so that if those engaged in the administration should delay or practise hypocrisy in the matter of those seeking justice, the oppressed might come to this chain, and shake it so that its noise might attract attention. Its fashion was this: I ordered them to make a chain of pure gold, 30 gaz in length and containing sixty bells. ....One end of it they made fast to the battlements of the Shāh Burj of the fort at Āgra, and the other to a stone-post fixed on the bank of the river." (*Tūzuk-i-Jahāngīrī*, Rogers and Beveridge, Trans. I, 7.) Mr. Beveridge notes: 'Du Jarric who got his information from missionary reports, seems to imply that the chain was of *silver*, and says that Jahāngīr was following the idea of an old Persian King. It is mentioned in the 'Siyaral-Muta'akhkhirīn' (Reprint, I, 230) that Muhammad Shāh in 1721 revived this, and hung a long chain with a bell attached to it from the octagon tower which looked towards the river." (*Ibid.*)

Sir H. Elliot confidently declares, that Jahāngīr's chain does not "appear to have been ever shaken, and probably was never meant for anything but parade. The practice was a mere imitation of what was attributed to one of the early Chinese Emperors, Yu-tu. 'Modern Universal History,' Vol. VII, p. 206. And Raja Anangpal had already done the same at Dehlī. See extract from Mīr Khusrū's *Nuh Sipihr*, supra, Vol. III, p. 565." Elliot and Dowson, VI, 262.[1]

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[1] Jahāngīr's bell of justice is described also by Captain Hawkins. ('Hawkins Voyages,' Hakluyt Society's Edition, 1878, p. 434). Mandelslo, who was in India in 1638-9, and paid a visit to Āgra has a similar account, from which it would seem that the institution was kept up by Shāh Jahān. ('Travels into the East Indies,' Eng. Trans. of John Davies, 2nd ed. 1669, p. 36.) Manucci says that when Shāh Jahān "directed the empire, officials walked so uprightly, that in spite of the daily beating of *the big drum* to call into his presence anyone wanting to complain of having received an injustice, months and months would pass

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I have not found the epithet in juxtaposition with the name of Āgra in the histories.

دارالفتح 'Abode of Victory,' is found on Aurangzeb's coins of Ujjain about 1073 A.H. Khāfī Khān has a statement on the subject which leaves little room for doubt as to the origin of the epithet. He tells us that soon after the defeat of Dārā's generals, Jaswant Singh and Qāsim Khān, at Dharmātpūr (seven koss from Ujjain), Aurangzeb bestowed upon "Khwāja Kalān Khwāfī—the author's uncle—the substantive appointment of Diwān of Ujjain, *to which he now gave the name of Dāru-l-Fatḥ*, and the acting charge of the Ṣubadārī [of the province of Mālwa] on behalf (*or* in place) of the Prince [Murād Bakhsh]."

بخواجه کلان خوافي که خالوی مصنف اوراق مي شد اصالة دیواني اجین
که بدارالفتح موسوم ساختند و نیابة صوبه داري از طرف شاه زاده عطا فرمودند

Bibl. Ind. Text, II, 19, ll. 15-17.

Manucci also informs us that "Aurangzeb gave orders to put up on the site [of the battle near Ujjain] a sarāe and plant a garden, calling it Fatehpur (Fatḥpūr)—that is to say, 'Filled with victory.'" Mr. Irvine suggests that "this may be identical with the Fatḥābād, twelve miles south-west of Ujjain (Thornton, 'Gazetteer,' 315)." 'Storia do Mogor,' Trans. I. 260 and note. See also Sarkar, 'India of Aurangzeb,' p. cxiii, and Tod, 'Rajasthan,' Reprint 1898, pp. 874, 1369.

Similarly, another town and sarāī called Fatḥābād was founded by the same Emperor on the site of the battle of Samūghar near Āgra, "in commemoration of the victory obtained by him over his brother Dārā Shikoh." This Fatḥābād is also known by the name of Ẓafarnagar. Elliot, 'Supplemental Glossary,' ed. Beames, II, 87.

دارالملک 'Seat of sovereignty or royalty,' is a very old epithet of Kābul, as will be seen from the references given in another part of this paper. Aurangzeb, however, was the first to associate it with the name of the chief town of Afghānistān on the coins.

دارالملک and also the double epithet دارالملک حضرت figure on the coins of Humāyūn and Akbar which issued from Dehlī.

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without any one coming to lodge a petition." Irvine, *Storia*, II. 20. Ibn Batuta informs us that "Shamsu-d-dīn Altamsh [*recte* Iltutmish] placed at the door of his palace two marble lions ..... These lions had an iron chain round their necks, from which hung a great bell. The victim of injustice came at night and rung the bell, and when the Sultān heard it, he immediately inquired into the case and gave satisfaction to the complainant." (Elliot and Dowson, III. 591).

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But neither title reappears on the Dehlī mintages of any of their successors. In the historical literature, however, دارالملک دهلي occurs not only in Niẓāmu-d-dīn Aḥmad, Badāonī and Abūl Faẓl but in some of the later works, *e g. The Iqbālnāma-i-Jahāngīrī*, *Bādishāhnāma*, etc.

The epithet on a copper coin of Fatḥpūr dated 979 A.H. (see P.M.C. Introd., xc) was read as دارالضرب by Rodgers. Mr. Nelson Wright has pronounced the reading to be "not convincing." The last word appears to him to be لضة ر. I venture to offer, for what it is worth, the suggestion that it is حضرت, with *perhaps*, دارالملک prefixed to it.

حضرت فتحپور is found once in the *Ṭabaqāt-i-'Akbarī*. In his account of the 14th year of the reign (976-7 A.H.) Niẓāmu-d-dīn tells us that the Emperor "resolved to make *Ḥaẓrat-i-Fatḥpūr* his capital and gave orders for the construction of a strong fort round the town." [1]

* حضرت فتحپور را پای تخت قرار داده قلعهٔ سنگین بر دور شهر فرمودند

Lakhnau Lithograph, 288, ll. 14-15.

It is quite possible that the old epithet of the imperial town of Dehlī was transferred at this time to the new metropolis. The last word of this epithet may, perhaps, be نصرت (victory). It is very difficult to say what precedes it, as so little of the latter has come on the coin.

دارالمنصور—House of Victory (?). The tentative reading of the epithet on an Ajmer dām dated 979 A.H. is دارالمنصور. The coin was first published by Rodgers ('Ind. Ant.,' 1890, p. 223, Pl. II, 28). He read the word in the second line of the obverse as منصو(ر), but confessed his inability to make out "the meaning of *mansūr* and the letters above that word."

دارالمنصور is Mr. Nelson Wright's suggestion (I.M.C. III, No. 358), but he is not sure of having correctly deciphered the title (Introd. xxv), and does not attempt to explain its significance. Mr. Whitehead also declares that the "epithet has not been satisfactorily read." (P.M.C. Introd. xxix.)

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[1] I ought perhaps to say that these words are susceptible of a very different interpretation. The sentence may be translated thus also :—

"His Majesty (حضرت) fixed on Fatḥpūr as his capital, and gave orders for the construction of a strong fort round the town."

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In this connection, the fact that Jodhpūr which "first appears as a Mughal mint on rupees struck in the name of Aḥmad Shāh is associated with the title *Dāru-l-Manṣūr*, 'abode of victory.'" (P.M.C. lxvii) is perhaps not devoid of interest. It is not easy to say why the Rāṭhors selected دارالمنصور as the distinctive appellation of their capital, or what peculiar affinity existed between it and 'Victory.' Indeed, I am not quite sure that the epithet is not susceptible of another interpretation.

منصور, according to Steingass, signifies, "aided, defended, protected (by God), triumphant, victorious." Thus, دارالمنصور may also mean 'House or abode (or city) under Divine protection,' and it is scarcely necessary to say that, in that sense, it would be just the designation which we should expect to be chosen for Ajmer by Akbar. It may be also perhaps worthwhile to recall that Ajmer had belonged to the great Rāṭhor prince Māldeo before it came into the possession of Akbar. It was jealously retained by the Mughals up to 1721, "when Ajit Singh, son of Rājā Jaswant Singh of Mārwār, took advantage of the decline of the Mughal empire, killed the imperial governor, and seized Ajmer. Muhammad Shāh recovered the city; but ten years later, he appointed Abhai Singh, the son of Ajit Singh, to be Viceroy of Ajmer and Ahmadābād, and from 1731 to 1750 the Rāṭhor princes of Mārwār ruled over Ajmer. A struggle for the succession led to the calling in of the Marāṭhās, to whom Bijai Singh, the successful competitor, made over the fort and district of Ajmer as *mund katī* or 'blood money' for the murder of Jai Appa Sindhia, their general." From this time until its cession to the British in 1818, Ajmer was held by Sindhīa, except for about three years 1787-90 A.C. ('Imp. Gaz.' V. 142). See also Tod, Rajasthan, Calcutta Reprint, 'Annals of Marwar,' Vol. II, Chap. XIII, pp. 950-965).

The earliest coin of Jodhpūr in the Panjāb Museum is dated 1165 A.H., 5 R. (1752 A.C.). Can it be that the Rāṭhors were familiar with the epithet on account of their connection with Ajmer, and that they transferred it to Jodhpūr? Unfortunately, there is no evidence (except that of the still doubtful reading of the title on this Dām) of Ajmer having been *generally* known as *Dāru-l-manṣūr*.

The epithets (احمد آباد) زینت البلاد and زین البلاد have been discussed by Mr. A. Master in Num. Sup. XXI, Art. 124, and I have nothing to add. Attention, however, may be invited to the following passage in which the historian Firishta bears his testimony to Aḥmadābād's title to be called the "Beauty or Ornament of Cities."

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"The houses of Ahmudabad are in general built of brick and mortar, and the roofs tiled. There are three hundred and sixty different mohullas, each mohulla having a wall surrounding it. The principal streets are sufficiently wide to admit of ten carriages abreast. It is hardly necessary to add that this is, on the whole, *the handsomest city in Hindoostan and perhaps in the world.*" Briggs' Translation, IV, 14. The last sentence is thus expressed in the original:

دیگر خصوصیات احمد آباد اگر گفته شود که در تمامی هندستان بلکه در
کل جهان بآن عظمت و آراستگی شهری موجود نشده مبالغه نبوده باشد *

(Lakhnau Lithograph, II, 183, ll. 18-19.)

A European contemporary, William Finch, thus describes the city about 1611 A.C.

" Amadabade or Amdavar is a goodly City, and scituate on a faire River, inclosed with strong walls and faire gates, with many beautifull Turrets, * * * *. *The buildings comparable to any Citie in Asia or Africa*, the streets large and well-paved, the Trade great (for almost every ten dayes goe from hence two hundred Coaches richly laden with Merchandise for Cambaya), the Merchants rich, the Artificers excellent for Carvings, Paintings, Inlayd Workes, imbroydery with Gold and Silver." Purchas 'His Pilgrimes,' MacLehose's Reprint, 1905, IV, 63.

The double epithet دارالسلطنت شهر معظم has been deciphered on some silver coins dated 981 A.H. which are most probably of the Aḥmadābād Mint. "The title شهر معظم has been read" says Mr. Whitehead, " on some copper coins struck by Muẓaffar III of Gujarāt in the years 977 and 978," but does not occur on any Mughal coin." (P.M.C. Introd. xxxv).

It may be perhaps worthwhile to invite attention to the fact that this title is frequently coupled with the name of the town in the *Mirāt-i-Sikandarī*, a valuable history of Gujarāt written about 1611 A.C., that is to say, in the reign of Jahāngīr. Shaikh Sikandar, the author, does not expressly say that it was bestowed upon it by Aḥmad Shāh I, but it occurs more than once in his description of the foundation of the city by that Sulṭān. The phrase شهر معظم also arrests attention in the verses composed in honour of the occasion by a contemporary poet named Ḥalwī Shīrāzī;

به الهـــام غیبـــي بحکم الله * چنیـــن آمد اندر دل پادشاه
که در آن زمین مـــروّج هوا * کند تازه شهـــر معظـــم بنا

Mirāt-i-Sikandarī, Bombay Lith., 1831, p. 25, ll. 5-6. The honorific is prefixed to the name of Aḥmādābād in the *Mirāt-i 'Aḥmadī* also.

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Abū-l-Faẓl's description of the city as it was even in his day is not undeserving of quotation: "It is," he says, "a noble city in a high state of prosperity. ....For the pleasantness of its climate and its display of the choicest productions of the whole globe, it is almost unrivalled. It has two forts, outside of which are 360 quarters of a special kind which are called *Porah*, in each of which all requisites of a city are to be found. At the present time, only 84 of these are flourishing. The city contains 1000 stone mosques, each having two minarets and rare inscriptions." Jarrett, Trans. 'Āīn.'. II, 240.

Champāner is styled شهر مكرّم August or illustrious city, on some copper coins of Humāyūn dated 942 A.H. The epithet is frequently met with, in conjunction with the name of the town, on the silver coins of Maḥmūd Begaḍa of Gujarāt from 895 to 904 A.H. That ruler "raised a noble city at the base of the hill, bringing his ministers and court from Aḥmadābād, made it his capital and styled it Mahmūdābād (*sic*) Chāmpāner" ('Imp. Gaz.' X, 135). We have seen that Aḥmadābād rejoiced in the designation شهر معظم. Champāner or Muḥammadābād, the rival capital, was now entitled شهر مكرّم. Both these appendages are really "borrowed feathers." In Persian and Arabic literature, the commonest epithet of Makka is معظمه, that of the companion city of Medīna, مكرّمه. The Gujarāt Sulṭāns appear to have transferred these honorifics to their favourite foundations. The prefix مكرّم occurs in Abū Turāb Walī's 'History of Gujarāt.'

اُردوی ظفر قرین The Lāhor Museum possesses a Shāh-rukhī of Bābur having the simple mint-name. اردو 'Camp,' but the honorific *Ẓafarqarīn* is found in conjunction with it for the first time only on the mintages of his grandson. The earliest coins are dated 984 A.H., and there are also a few square rupees and copper coins without a date. Excepting these, all Akbar's issues from the 'Camp associated with Victory' until the thirty-fifth year of the reign purport to be of 1000 Hijrī, and the date on all of them is not expressed as usual in Persian words or numerals, but by the Arabic vocable الف. This fact has given rise to numerous speculations, and Mr. Lane Poole thinks it possible that "the name Urdū Zafarkarīn may possess some mystical import," and may "bear some such signification, in the mystical phraseology of the Shī'ah, as 'Camp of the approaching triumph of the Faith.'" (B.M.C. lii). Mr. Whitehead does not go so far, but declares that "the phrase was coined by Akbar." A study of Persian

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historical literature shows that neither of these surmises is well-founded. Phrases having the same import as *Urdū-i-Ẓafarqarīn* occur very frequently in several standard histories which were written long before the birth of Akbar. In the 'Ẓafarnāma' of Sharfu-d-dīn 'Alī Yazdī, a contemporaneous glorification of Tīmūr (written in 1424 A.C., *Vide* E.D. III, 478), I have noted the following synonymous expressions.

اردوی اعلی 'Ẓafarnāma,' Bibl. Ind. Edition, I, 342, 406, 413, 419; II, 164, 208, 215, 336, 349, 643.

اردوی ظفر مکان *Ibid.*, II, 426.

اردوی گیہان پوی II. 90, 315, 318, 324, 346, 353, 354, 358, 373, 375, 378, 399, 459, 498, 512, 515, 556, 561, 570.

اردوی ہمایون II, 258, 282, 335, 381, 504, 550; II, 10, 154, 227, 244, 377, 437, 491, 523, 567.

رایت ظفر قرین II, 52, 87, 480.

معسکر ظفر آشیان II, 63.

معسکر ظفر پناہ I, 78, 140, 197, 199, 419, 552; II, 30, 42, 45, 47, 49, 57, 58, 87, 92, 171, 264.

معسکر ظفر قرین I, 529; II, 32, 60, 129, 150, 221, 266, 291, 313, 345, 378, 380, 398, 399, 421, 464, 468.

معسکر ظفر مآب I, 324; II, 96, 127, 540.

معسکر ہمایون I, 83, 197, 261, 296, 335, 339, 376, 465; II, 59, 62, 73, 82, 174, 349.

موکب ظفرقرین I, 253, 311, 360, 568; II, 12, 65, 77, 82, 134, 186, 191, 223, 238, 348, 359, 372, 464, 500, 505, 516, 574, 638.

Similar locutions occur frequently in the 'Rauẓatu-s-Ṣafā' of Mīrkhwānd and the 'Ḥabību-s-Siyar' of Khwāndmīr, as will appear from the following:—

اردوی اعلی 'Rauẓatu-s-Ṣāfa' (History of Tīmūr and his Descendants), Bombay Lithograph, VI, 23, 68, 84.

اردوی جہان پوی 'Rauẓat.,' *Ibid.*, 86, 114.

اردوی کیہان پوی 'Ḥabību-s-siyar' (Bombay Lithograph, History of Timūr, III, iii, 39, 298).

اردوی ظفر نشان 'Rauẓat.,' *Ib.*, 204; 'Ḥabīb.,' *Ib.*, 31.

اردوی نصرت قرین 'Rauẓat.,' *Ibid.*, 87.

اردوی نصرت نشان 'Ḥabīb.,' *Ib.*, 32, 324

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اردوی همایون ' Rauẓat.,' *Ib.*, 47, 68, 76, 116 ; ' Ḥabīb.,' 20, 42, 47, 109.

مخیم اقبال ' Rauẓat.,' *Ib.*, 88, 97.

معسکر اقبال مآل ' Ḥabīb.,' *Ib.*, 36.

معسکر ظفر اثر ' Ḥabīb.,' *Ib.*, 22, 58, 269.

معسکر ظفر پناه ' Rauẓat.,' *Ib.*, 86.

معسکر ظفر قرین ' Rauzat.,' VII, 20 ; ' Ḥabīb.,' III, iii, 50.

معسکر فیروزی اثر ' Rauẓat.,' *Ib.*, 110.

معسکر همایون ' Ḥabīb.,' *Ib.*, 47, 50, 56, 57, 59.

موکب ظفر قرین ' Rauẓat.,' *Ib.*, 104 ; ' Ḥabīb.,' *Ib.*, 37.

موکب همایون ' Rauẓat.,' *Ib.*, 87, 89, 103, 205 ; ' Ḥabīb.,' *Ib.*, 20, 25, 41, 72, 116.

A glance at the passages referred to must convince every one that the phrase cannot possibly have anything 'mystical' about it. It may or may not be thought easy to say what was intended to be conveyed by the word الف, but it is quite certain that neither Akbar nor Abūl Fazl was responsible for coining the expression. I have found it in the *Tārīkh-i-Firūz-shāhī* of Shams-i-Sirāj 'Afīf, a contemporary history of Sulṭān Firūz Shāh Tughlaq. In his account of the "mistake made by Khwāja-i-Jahān Aḥmad Ayāz in setting up the son of the late Sulṭān Muḥammad Shāh," the writer says :—

نقل است که چون خواجه جهان اخبار دولت سلطان شنید بر غلط خود تاسف بسیار خورد و در هر دو لشکر اخبار مختلف مذکور میشد که خواجهٔ جهان بر آن قرار داده که چون لشکر سلطان بدهلي رسد امرا که در اردوی ظفر قرین اند اتباع آنهارا در پله منجنیق نهاده خواهد انداخت *

Bibl. Ind. Edition, 53-4.

Unfortunately the passage is differently worded in some manuscripts, which have لشکر instead of اردوی ظفر قرین, and it would appear from Dowson's translation that his copy also had لشکر (Elliot and Dowson, III, 280). It is possible that the two words were interpolated by some copyist, but no such doubts can attach to the following quotation from Khwāndmīr's account of Bābur in the 'Ḥabību-s-Siyar.'

درآن منزل امیر سلطان احمد قراول که پدر قوچ بیک و بعد از واقعهٔ میرزا بایسنقر با برادران و کوچ و متعلقان از قراتکین متوجه اردوی ظفر قرین گشته بود بعز بساط بوسي استفاد یافت *

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Bombay Lithograph, III, iii, 295, four lines from foot.

"In that place (*lit.* stage in travelling), Amīr Sulṭān Ḥusain Qarāwal, the father of Qūch Beg, who had after the murder (*lit.* accident, calamity) of Bāisanqar left Qarātigīn with his brothers, family and dependants and turned his face towards "*the Camp associated with Victory*," acquired the honour of kissing the carpet [of Bābur]."

This passage leaves no room for doubt that the phrase itself has nothing peculiar or mystical about it, and that it is much older than Akbar or Akbar's religious innovations. The Mongols of the Golden Horde and of Persia had struck coins at اردو المعظم , اردو بازار and اردو الجدیدہ. Osmanlī mintages of اردوی همایون, are also known. (Codrington, Musalmān Numismatics, 136).

"Timūr himself," says (Sir) Clements R. Markham, "was of the race of Turkish wanderers. ....His countrymen lived in tents, loved the wandering lives of warlike shepherds, better than the luxury and ease of cities, and even in the countries which they had conquered, preferred an encampment in the open plains to a residence in the most splendid palaces." ('Narrative of the Embassy of Ruy Gonzalez de Clavijo to the Court of Timūr,' Introd. p. viii.)[1]

The Imperial dwelling or residence thus came to be called the اردو (or معسکر) even when it was not under tents but in a marble palace, and then all sorts of complimentary epithets like اعلیٰ , معلّیٰ , ظفر قرین and همایون were affixed to it. The Mongols of the *Golden* Horde were so called merely because Bātū, the grandson of Jenghīz (Changīz) Khān, established himself in his magnificent tent (*Sir Orda*, Golden Camp) at Sarāī on the Volga,

The Urdū mintages of the Mongols are well known, and Sharfu-d-dīn, the biographer of Tīmūr, informs us that the income from the دارالضرب اردوی اعلیٰ 'the Mint of the Exalted Camp,' was six hundred thousand *Dīnār-i-Kabakī* soon after the sack of Damascus by that conqueror (*Ẓafarnāma*, Bibl. Ind. Text, II, 336, ll. 8-9). There is little or no difference between

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[1] The following extract from the 'Voyage to East India' of Edward Terry, Sir Thomas Roe's chaplain, shows that this taste for camp-life was inherited by Timūr's descendants, the Indian Mughals, and throws useful light on the real meaning of such expressions as *Muaskar-i Iqbāl* and *Urdu Ẓafarqarin*:

"All the great men there live a great part of the year, in which their months are more temperate, (as from the middle of September to the middle of April), in tents, pavilions or moveable habitations, which according to their fancies, they remove from place to place, changing their air as often as they please." *Op. Cit.* Edit. 1777, p. 176.

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اردوی اعلی and اردوی ظفر قرین, and there can be little doubt that in both cases the reference is to what Abūl Faẓl calls, the سرا ضرب حضور, the mint-establishment which accompanied the monarch on his progresses and expeditions.

فرخنده بنیاد 'Of happy foundation' is found inscribed for the first time on the Ḥaidarābād coins of Shāh 'Ālam I. There can be no doubt that the new title was invented by Bahādur Shāh himself. Khāfī Khān explicitly says as much.

حکم فرمودند که حیدر آباد را بعد از تسخیر عهد خلد مکان دارالجهاد
می نوشتند فرخنده بنیاد حیدرابادمی نوشته باشند *

Text, II, 646, ll. 4-5.

"He [*scil.* the Emperor] gave orders that Ḥaidarābād which had been, after its conquest in the days of Khuldmakān, [the after-death title of Aurangzeb] written *Dāru-l-Jihād*, should *henceforth* be styled *Farkhunda buniyād-i-Ḥaidarābād*."

The alteration is not perhaps, difficult to account for. The battle in which Kāmbakhsh had been defeated and killed in Zīl-Qa'ada, 1120 A.H. had been fought within three koss of Ḥaidarābād, that is to say, in the immediate vicinity of the city (Khāfī Khān, II. 621). That battle had removed the last of his rivals, and the place had been truly *of good omen* to him. Shāh 'Ālam Bahādur had, it must be remembered none of the zeal or bigotry of his father. The epithet *Dāru-l-jihād* must have seemed to him needlessly offensive and provocative of the hostility of his Hindū subjects.[1] Besides, it was now nearly twenty years since the capital of the Quṭbshāhī rulers had become a part of the Empire. The infidel "customs and other innovations which its irreligious or heretical sovereigns had introduced," had been long since rooted out. The two most important cities in the Southern Ṣubas were Aurangābād and Ḥaidarābād. His father had given the former the distinctive appellation, *Khujista buniyād* in grateful remembrance of the fact of that city having witnessed, as it were, the beginning of his fortunes. Ḥaidarābād had, in like manner, proved to be auspicious to himself, and he must have naturally felt inclined to devise some title differing in form from and at the same time having the same import as the designation of the rival

[1] Mr. Lane Poole has done justice to this side of the Emperor's character. "He was then (*i.e.* at his accession) a man of sixty-four: naturally of a conciliatory and merciful disposition, the blood he drew from his Hindu mother made him benignant to his Indian subjects and should have recommended him to his kinsmen, the refractory Rājputs. His philosophical studies indeed laid him open to the charge of being too much of a Hindu for the approbation of honest Muslims. (B.M.C. Introd. xxxiii).

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city. Aurangābād had been, by his predecessor, styled *Khujista*-buniyād. He would not be backward in having a favourite of his own, and would call it *Farkhunda*-buniyād.

It is perhaps worth noting that the original name of Ḥaidarābād was Bhāgnagar, and it is by that name only that it is spoken of by Tavernier ('Travels,' ed. Ball. I, 150, 151, 156, 162, 167), Fryer ('A New Account of East India and Persia,' ed. Crooke II, 44. 48), Manucci ('Storia do Mogor,' tr. Irvine, II, 445 ; III, 506 ; IV, 98) and other European travellers of the 17th century. Firishta informs us that Muḥammad Qulī Quṭb Shāh "built a magnificent city at the distance of eight miles" from Gulkanda, "which he called Bhagnuggur after his favourite mistress," a "public singer of the name of Bhagmutty" (Briggs' Translation, III, 335. See also *ibid.*, III, 451.) Similar statements occur in the *Maāṣir-i-Ālamgirī* Bibl. Ind. Text, p. 302) and 'Khāfī Khān' (Text II, 369 or Elliot and Dowson, VII, 336). Now, *Bhāg* means 'Good Fortune,' and *Bhāgmatī* 'Full of good fortune.' 'Bhāgnagar' itself would signify 'City of good fortune,' very much the same as '*Farkhunda Buniyād.*' It may be not unreasonably supposed that this had some influence on the mind of the inventor of the new title of honour.

On the coins of Pānīpat and Barelī there is an epithet which has been read as قطعة. Mr. C. J. Brown has recently suggested that this is erroneous so far at least as the Panīpat issues are concerned, and that the word is really قصبه. Mr. Whitehead has accepted the emendation, and I may be perhaps permitted to say that I had ventured to entertain the same opinion long before its publication in Num. Sup. XXV (p. 234). قصبه پانی‌پت is a collocation which is not infrequently met with in the historians *e.g. Ṭabaqāt-i-Akbarī*, 245, 301 ; *Akbarnāma*, II, 35, 37, 38, 39 ; '*Ālamgīrnāma*, 220, 849, but قطعهٔ پانی‌پت I do not remember to have ever seen.

قطعه means 'a segment, section, portion, piece, slice, morsel' and has several other significations also according to the Dictionaries, but '*a territorial division*' small or large, does not appear to be one of them. Its plural form اقطاع is exceedingly common in the sense of 'land assigned for military or other service,' in other words, a jāgīr. Several other terms also for small or large territorial or administrative divisions occur frequently in the historians of the so-called 'Paṭhān' and Mughal periods, *viz.*

چکله - تعلقه - پرگنه - بندر - بلده - اولکه - موضع - ملک - معموره - عرصه - ضلع - صوبه - شهر - سرکار - ساحت - دیار - خطه - حصن - حصار - ولایت and اقلیم

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There is nothing honorific about them, and every one of them may, with perfect propriety, be applied to and is actually found in conjunction with a score at least of Indian toponyms. مستقرالخلافت 'Resting-place of Empire' attracts notice as the distinctive title of Akbarābād on the coins, only about the 30th year of Aurangzeb's reign, but the epithet is often used for Āgra, or actually associated with the name of the town in the contemporary chronicles of the reigns of Shāh Jahān, Jahāngīr and even Akbar.

At some time in the first year of his reign, Bahādur Shāh, Shāh 'Ālam I, appears to have introduced a change. Akbarābād was henceforth to be called مستقرالملک and its own appellation مستقرالخلافت was to be transferred to Ajmer. This was probably done when the Emperor was encamped at or in the near neighbourhood of that town on account of the troubles in Rājpūtāna.

Ajīt Singh of Jodhpūr had "after the death of Aurangzeb," writes Khāfī Khān, "again showed his disobedience and rebellion by oppressing Musalmāns, forbidding the killing of cows, preventing the summons to prayer, razing the mosques which had been built after the destruction of the idol-temples in the late reign, and repairing and building anew idol-temples. He warmly supported and assisted the army of the Rānā of Udipūr, and was closely allied with Rāja Jaisingh, whose son-in-law he was. He had carried his disaffection so far that he had not attended at Court since the accession. On the 8th [7th in text] Sha'abān [1st year], the Emperor marched to punish this rebel and his tribe, by way of Amber, the native land of Jaisingh." Elliot and Dowson, VII. 404-5. The camp is expressly said to have been between Ajmer and Chitor when the month of Ramazān arrived.[1] Text, II, 606, ll. 2-3. The Emperor was at Ajmer itself soon afterwards, and paid the customary imperial visit to the shrine of the 'great Khwāja.' *Ibid.*, 608, ll. 18-20.

He appears to have stayed there for some time, and left only when the hostile proceedings of Kām Bakhsh and the near approach of the rainy season rendered it necessary to march forthwith to the Dakhan. *Ibid.*, 616, ll. 4-5. It may, I think, be reasonably conjectured that the earliest coins of

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[1] Some interesting 'Mughal Farmāns, Parwānahs and Sanads have been recently published in *facsimile* with text and translations by the Reverend H. Felix. One of these documents is addressed to "the present and future collectors of the Jizya in the Ṣūbas of *Mustaqirru-l-Mulk* and *Dāru-l-Khilāfat* and is dated the 14th of the blessed Ramazān in the first year of the exalted accession." [1119 A.H.] In two other papers also the صوبه مستقرالملک اکبرآباد is expressly mentioned. Journal of the Panjāb Historical Society. Vol. V. (1915), pp. 32, 33, 35.

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مستقر الخلافت اجمیر were struck when the imperial head-quarters were at or in the vicinity of the town. The recrudescence of the Rājpūt troubles compelled him to leave Burhānpūr in Sha'abān 1121 A.H., and he was again at Ajmer for some months in the next year. Then the insurrection of the Sikhs drove him to the Panjāb, and his camp was pitched at Lāhor in Jumāda I, 1122 A.H., where it remained till his death in Muḥarram 1124 A.H.

مستقر الملک continued to be the epithet of Akbarābād in the reign of Jahāndār, and the first four years of Farrukhsīyar. Some time in the 5th year of the latter, another change took place. Its old epithet مستقر الخلافت was restored to Akbarābād. and Ajmer was deprived of it and ordered to be called دارالخیر as before. مستقر الملک itself was transferred to 'Aẓīmābād (Patna). But there was for some time a certain amount of confusion, and on the coins of the 3rd, 4th and 5th years, Akbarābād and 'Aẓimābād are *both* styled مستقر الملک (P.M.C. Nos. 2163-6 and 2230-33).

مستقر الملک 'Resting place of sovereignty.' We have seen that when Ajmer was entitled مستقر الخلافت, Akbarābād came to be called مستقر الملک. When their old titles were restored to Akbarābād and Ajmer, مستقر الملک remained unappropriated and was available for transference to some other town. The imperial choice descended upon 'Aẓīmābād (Patna), and the reason of the same is not difficult to divine.

Khāfī Khān informs us that when 'Aẓīmu-sh-shān was summoned to court some time before the death of Aurangzeb, his son, Farrukhsiyar was left behind as his deputy in Bengal. The latter remained there in that capacity during almost the entire reign of Shāh 'Ālam I. In the fifth year, he was ordered to hand over the administration of the Province to 'Izzu-d-daula Khān-i-Khānān Bahādur and proceed to Court. Arriving in Patna he made a halt, and put forward his want of means and the approach of the rainy season as excuses for delay.

درین ضمن بعضی درویشان ریاضی دان باتفاق محمد رفیع نام حکیم که از علم تنجیم نیز بهرهٔ وافر داشت محمد فرخ سیر را از مژدهٔ نصیب شدن تخت در همان سر زمین مبشر ساخته وسلیمهٔ پیش آمدن خود ساختند این معنی زیادہ باعث توقف و مکث او دران ضلع گردید *

Bibl. Ind. Text, II, 708, ll. 5-10.

"At this conjuncture, several Dervishes acquainted with the mathematical sciences together with a physician

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named Muḥammad Raf'ī, who also possessed a considerable knowledge of astrology, imparted to Farrukhsīyar the glad tidings of his being destined to [ascend] the throne *in that very spot* ['Aẓīmābād Patna], and they made this the means of their own advancement. This information induced him to stay and delay longer in that *zill'a*."

Once more he writes:

و در همان ایام خبر رحلت بهادر شاه بادشاه ازین جهان فانی بروضهٔ جاودانی رسید و محمد فرخ سیر بعد از استماع این خبر بدون تحقیق انفصال مقدمه میان برادران خطبه بنام عظیم الشان خوانده سکه باسم پدر زده برای رساندن خود بمدد عظیم الشان با همراهان مصلحت نمود بعضی درویشان دنیا طلب و محمد رفیع منجم مانع آمده گفتند که حرکت تو ازین مکان میمنت نشان بدون انکه خود در اینجا صاحب سکه و خطبه شوی صلاح دولت نیست *

Ibid., II, 710, ll, 13-19.

"About the same time, the news of the departure of the Emperor Bahādur Shāh from this transitory world to the Garden of Eternity arrived. Muḥammad Farrukhsīyar had the khuṭba read in the name of 'Aẓīmu-sh-shān, and coins struck with his father's titles [immediately] on the receipt of these tidings, without ascertaining the result of the contest between the brothers. He then sought the advice of his associates about [the wisdom of] of going to the assistance of 'Aẓīmu-sh-shān. Some worldly Dervishes and Muḥammad Raf'ī, the astrologer, forbade it, and said 'It is not advisable for you (*lit.* not in the best interests of your good fortune or Empire) to move at all from *this spot of auspicious character* until you have yourself been proclaimed (*lit.* become) the Lord of the *khuṭba* and the *sikka*."

Subsequently the historian tells us that on learning of the death of his father, he had the Khuṭba read and coins struck in his own name at 'Aẓīmābād in the beginning of Rab'īul-awwal, corresponding to the second decade of Fravardīn, 1123 A.H. (*Ibid.*, II, 711, ll. 10-13; See also Irvine, 'Later Mughals,' J.A.S.B. 1896, pp. 171-2. The correct year is 1124 A.H.).

In a word, the prophecy of the "worldly Dervishes and Muḥammad Raf'ī, the astrologer," had somehow come to be true. Farrukhsīyar was crowned at Patna in the *bāgh* or garden known as Afẓal Khān's (Irvine, *loc. cit.* 172) and ultimately did become Emperor. The city had been thus unmistakeably associated with the rise of his fortune. Here, his power had first taken root, and it had been the first "dwelling-place of his kingdom." The epithet finds no place in the historians.

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Part II.

In the preceding pages, I have tabulated the descriptive or honorific epithets which arrest attention on the coins of the Mughal Emperors of India, and attempted to throw some light on the origin of the most characteristic and remarkable of those appellations. We have now to inquire if similar titles are associated with the names of the mint-towns in the authoritative annals of the dynasty. In other words, we have to ascertain how far the numismatic evidence is in agreement or conflict with the historical. It is scarcely necessary to say that for the purposes of this investigation we can rely only on the contemporary chronicles of the Indian Mughals which have been published.

I have already observed that the number of the prefixes which figure on the mintages of the first two Emperors is very limited, and that they make their appearance only on the issues in copper. We naturally turn for light to Bābur's famous 'Memoirs,' but they are really written in Turkī and to judge from Mrs. Beveridge's excellent translation, the imperial autobiographer rarely makes use of these flourishes. The only exceptions would seem to be in reference to Dehlī and Jaunpūr, to both of which the designation 'Capital' (دارالملک ?) is once or twice prefixed (A. S. Beveridge, *op. cit.* 481, 521).

There is little or nothing to be learnt on the subject from Stewart's translation of the 'Memoirs' of Humāyūn's ewer-bearer Jauhar. We have therefore to make use of the accounts of Niẓāmu-d-din Aḥmad and Abūl Faẓl though, strictly speaking, they were not contemporaries. For the reign of Akbar, however, in which these epithets first come into general vogue, the *Ṭabaqāt-i-Akbarī* of Niẓāmu-d-din, the *Muntakhabu-t-Tawārīkh* of Badāonī, the *Akbarnāma* of Abūl Faẓl and the *Tarīkh-i-Gujarāt* of Abū Turāb Walī furnish ample materials for comparison. The coins of Jahāngīr exhibit but two prefixes and a solitary suffix, but it is clear from the unimpeachable testimony of his own *Tūzuk* and the *Iqbālnāma-i-Jahāngīrī* of Mu'atamad Khān (written 1040 A.H.) that these honorific designations still held their ground in literature and official correspondence. A long list of the titles which were current in the reign of Shāh Jahān can be put together from the *Bādishāhnāma* of 'Abdul Ḥamīd Lāhorī. The *'Ālamgīrnāma* of Muḥammad Kāẓim, the *Maāṣir-i 'Ālamgīrī* of Muḥammad Sāqī Musta'id Khān, and the *second* volume of the *Muntakhabu-l-Lubāb* of Khwāfī Khān furnish the same sort of information for the half century during which the destinies of Hindustān were entrusted by Providence to Aurangzeb. The last four hundred pages of that volume are occupied with the history of Aurangzeb's successors up to Muḥammad Shāh. The contemporary chronicles of the last

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three puppets of the House of Tīmūr are still in manuscript, but the period itself is not of any great interest or importance from the point of view under consideration.

A list of all the Honorific Epithets associated with the names of towns in these historical works is given below with references to the page and volume, so as to make it easy for anyone who can read Persian to verify them.[1]

It may be perhaps necessary to add that all the references are to the Bibliotheca Indica editions except in two cases. The *Ṭabaqāt-i-Akbarī* has been available only in the Lakhnau lithograph and the *Tūzuk-i-Jahāngīrī* in the 'Alīgarh text of Sayyad Aḥmad Khān.

Wāqi'āt-i-Bāburī.

دارالملک Jaunpūr, Dehlī.

Ṭabaqāt-i-Akbari.

Bābur.

دارالامان (Āgra, Kābul); دارالسرور (Jaunpūr); دارالسلطنت (Āgra); دارالملک (Dehlī and Jaunpūr); ظفر قرین (Urdū);

Akbar.

حضرت (?) (Fatḥpūr); خطه مبارک (Ajmer); دارالخلافت (Āgra, Fatḥpūr, Lāhor); دارالسرور (Fatḥpūr); دارالسلطنت (Aḥmadābād, Fatḥpūr, Lāhor); دارالملک (Tānda, Dehlī); دارالملک حضرت (Dehlī), شهر معظم (Aḥmadābād); ظفر قرین (Urdū); مکه مشرفه.

Badāonī.

حضرت (Ajmer, Dehlī); دارالحرب (Goganda and Konbhalmer); دارالخلافت (Āgra); دار السرور (Peshāwar, Fatḥpūr); دوالملک (Tānda, Dehlī); ظفر قرین (Urdū); مکه معظمه.

Akbarnāma.

Bābur.

حضرت (Dehlī); دار الخلافت (Āgra,); دار السلطنت (Āgra); دار الملک (Āgra, Dehlī).

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1 I ought perhaps to say that I have not thought it worthwhile to swell these pages with references to the hundreds of passages in which such epithets as

حصن - حصار - چکله - تعلقه - پرگنه - بندر - بلده - اولکه - قصبه - ضلع - صوبه - شهر - سرکار - ساحت - ولایت - موضع - ملک - دیار - خطه - معموره - عرصه -

etc., are found in juxtaposition with the names of places.

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Humāyūn.

دار الخلافت (Āgra) ; دار السلطنت (Dehlī, Kābul) ; دار الملک (Dehlī, Kābul) ; ظفر قرین (Urdū).

Akbar.

بنگالهٔ دلخواه ; حضرت (Ajmer) ; خطه دلکشای (Ajmer, Jaunpūr, Dehlī) ; خطه فیض اساس (Ajmer) ; خطه فیض بخش (Ajmer) ; دار الاقبال (Fatḥpūr, Kābul) ; دارالامن (Kābul) ; دارالبرکت (Ajmer) ; دار الخلافت (Āgra, Fatḥpūr) ; دار السلطنت (Dehlī, Fatḥpūr Lāhor) ; دارالعیش (Kābul) ; دار الملک (Āgra, Tānda, Dehlī, Lāhor) ; دار النشاط (Kābul) ; شهر فیض بهر (Ajmer) ; ظفر قرین (Urdū) ; عرصهٔ دلکشای (Bangāla, Bihār, Kābul, Kashmīr, Lāhor, Hindūstān) ; عرصهٔ دلکشای شهر (Pattan-Nahrwāla) ; عشرت آباد (Fatḥpūr, Kābul) ; عشرت سرای (Kabul) ; قلعهٔ رفعت اساس (Chitor) ; کشمیر جنت نظیر ; معسکر اقبال ; مکه معظمه ; ملک دلکشای (Bangāla, Kashmīr).

Abū Turāb Walī (*Tārīk̲h-i-Gujarāt*).

حضرت (Dehlī) ; دار الخلافت (Aḥmadābād) ; دار السرور (Fatḥpūr) ; شهر مکرّم (Muḥammadābād, *i.e.* Chānpāner) ظفر قرین (Urdū) ; مکه معظمه ; مکه مشرفه.

Tūzuk-i-Jahāngīrī.

خطه دلکشای (Kashmīr) ; خطه جنت نظیر (Kashmīr) ; دارالبرکت (Ajmer, Dehlī) ; دار الخلافت (Āgra, Dehlī) ; دار السلطنت (Āgra, Lāhor) ; دار الملک (Dehlī) ; ظفر قرین (Urdū) ; گلزار همیشه بهار (Kashmīr) ; مستقر الخلافت (*for* Agra) ; معسکر اقبال.

Iqbālnāma-Jahāngīrī.

بلدهٔ طیبه (Burhānpūr, Mandū) ; بلدهٔ فاخره (Kābul) ; بهشت نظیر (Kashmīr) ; جنت نظیر (Kashmīr) ; خطه دلپذیر (Kashmīr) ; دارالبرکت (Ajmer) ; دار الخلافت (Akbarābād, Āgra, Dehlī) ; دار السلطنت (Lāhor) ; دار الملک (Dehlī) ; ظفر قرین (Urdū) ; گلزار همیشه بهار (Kashmīr) ; معسکر اقبال.

Bādishāhnāma.

خطه بینظیر (Kashmīr) ; خطه دلپذیر (Kashmīr) ; خطه دلکشای (Ajmer) ; خطه فیض اساس (Ajmer) ; دار البرکت (Ajmer) ; دار الخلافت (Akbarābād, Āgra, Shāhjahānābād) ; دارالخلد (Kashmīr) ; دارالخیر (Ajmer) ; دارالسرور (Fatḥpūr) ; دارالسعادت (Ajmer) ;

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دار السلطنت (Lāhor) ; دار العلم (Shīrāz) ; دار الملک (Dehlī, Kābul) ; مدینه مکرمه ; مدینه طیبه ; کشمیر جنت نظیر ; شهر کرامت بهر (Ajmer) ; هندوستان ; مکه معظمه ; معسکر اقبال ; (Akbarābād) ; مستقر الخلافت بهشت نشان.

ʿĀlamgīrnāma.

بلدهٔ طیبه ; اورنگا باد فیض بنیاد (Ajmer, Burhanpūr, Multān) ; بلدهٔ فاخره (Aurangābād) ; بلدهٔ فیض بنیاد (Aurangābād) ; بلدهٔ مبارکه (Burhānpūr) ; حصن سپهر بنیاد (Daultābād) ; حصن فلک اساس (Rohtās) ; خطه دلکشای (Aurangābād) ; خطه دولت بنیاد (Aurangābād) ; خطه فیض بنیاد (Aurangābād) ; دار الامان (Multān) ; دار السلطنت (Lāhor) ; دار الملک (Shāhjahānābād) ; دار الخلافت (Kābul) ; شهر کرامت بهر ، دولت آباد فیض بنیاد (Multān) ; قلعه سپهر بنیاد (Daulatābād, Shāhjahānābād, Gwāliār) ; قلعه محکم اساس (Gwāliār) ; کشمیر بهشت نظیر ; کشمیر جنت نظیر ; کشمیر دلپذیر ; مستقر الخلافت (Akbarābād) ; مکه معظمه ; هندوستان بهشت نشان ; هندوستان فیض مکان.

Maāṣir-i-ʿĀlamgīrī.

بندر مبارک (Sūrat) ; خجسته بنیاد (Aurangābād) ; دارالامان (Multān) ; دارالجهاد (Ḥaidarābād) ; دارالخلافت (Shāhjahānābād) ; دارالسرور (Burhānpūr) ; دارالسلطنت (Lāhor) ; دارالخیر (Ajmer) ; دار الظفر (Bijāpūr) ; دارالملک (Kābul) ; کشمیر جنت نظیر ; مدینه مشرفه ; مستقر الخلافت (Akbarābād) ; مکه معظمه ; هندوستان ; مدینه منوره بهشت نشان.

Khāfī Khān (Vol. II).

بندر مبارک (Sūrat) ; خجسته بنیاد (Aurangābād) ; دارالجهاد (Ḥaidarābād) ; دارالخلافت (Shāhjahānābād) ; (Fatḥpūr) ; دار الخیر (Ajmer) ; دارالسلطنت (Lāhor) ; دار الظفر (Bijāpūr) ; دارالفتح (Ujjain) ; فرخنده بنیاد (Ḥaidarābād) ; قبة الاسلام (Balkh) ; مستقر الخلافت (Akbarābād) ; مشهد مقدس ; هندوستان بهشت نشان ; مکه متبرکه ; مکه معظمه.

Shāh ʿAlam Nāma. (Incomplete).

(Ghulām ʿĀlī Khān).

دارالخلافت (Shāhjahānābād) ; دارالسلطنت (Lāhor) ; مستقر الخلافت (Akbarābād) ; معسکر اقبال.

اردوی ظفر قرین ' Ṭab. Akb.' (Bābur), 182, 183, 184, 186.
,, ,, (Humāyūn), 197.
,, ,, (Akbar), 253, 265, 284.

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'Bad.' (Akbar), II, 115.
'Akb. Nām.' (Humāyūn), I, 327.
,, ,, (Akbar), II, 62, 324; III, 105.
'Abū Turāb Walī,' 72.
'Tūz. Jah.' 31, 169, 171, 177, 245, 288, 291, 356.
'Iqb. Nām.' 136.

اورنگا باد فیض بنیاد — ''Ālam. Nām.,' 84, 925.
بلدهٔ زین البلاد احمد آباد — 'Mirāt-i-Aḥmadī,' Bombay Lithograph. A.H. 1306, Vol. II, 1.
بلدهٔ طیبه اجمیر — 'Ālam. Nām.,' 119.
بلدهٔ طیبهٔ برهان پور — 'Iqb. Nām.,' 99.
— ''Ālam. Nām.,' 1027, 1051
بلدهٔ طیبهٔ ملتان — ''Ālam. Nām.,' 210, 217.
بلدهٔ طیبهٔ مندو — 'Iqb. Nām.,' 100.
بلدهٔ فاخرهٔ اورنگاباد — ''Ālam. Nām.,' 1020.
بلدهٔ فاخرهٔ کابل — 'Iqb. Nām.,' 249.
بلدهٔ فیض بنیاد اورنگاباد — ''Ālam. Nām.,' 1084.
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A glance at this long list of References will be sufficient to show that the historical evidence is in fair accord with the Numismatic. Leaving out non-descript or colourless appellations like بلده - بندر - ثیرة - خط - دارالضرب - سوکار - شهر etc. and their compounds, we can reckon in all about thirty really distinctive titles on the Coins. Of these, about eighteen are found in the histories. Of the dozen of which there is no trace in the chronicles, about six— دارالسرور - دارالبرکات ناگور - دارالامان جمون دارالفلوس بنارس and - دارالمنصور جودهپور - دارالسلام مندسور - سهارنپور belong to the period of disruption and anarchy of which no really satisfactory or exhaustive Persian history has been published. Of the six which remain, one بلدهٔ فاخرهٔ برهانپور is found only on a single coin, two others were invented by the weak and vain Humāyūn, and their vogue is restricted to about six years in all. The absence of دارالسلام دوکاون may be satisfactorily explained by the fact that Dogāon itself is but once mentioned in the fifteen hundred pages of the ‘*Akbarnama*,’ and that the name occurs but twice in the almost equally voluminous *Āīn-i-Akbari*. There is no reference to مستقر الملک اکبر آباد in the chronicles, but I have called attention to its

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existence in the official documents of the period. It is not perhaps difficult to understand why the changes introduced by Shāh Ālam I in reference to the honorary designations of Akbarābād and Ajmer are not reflected in the history of Khāfī Khān. In the first place, the new designations were in use for a very short period. In the second, the title bestowed on Ajmer during a temporary emergency, was, under other conditions, neither applicable to nor deserved by it. The assignment of مستقر الملک to 'Aẓīmābād-Patna by Farrukhsīyar was due only to the fortuitous circumstance of his having been crowned there, and even in his own reign, the new title was not consistently applied. There is therefore, nothing to be wondered at in Khāfī Khan having not thought it worth while to introduce confusion into his own pages by prefixing to the names of these towns ephemeral designations which were capriciously altered with such bewildering frequency.

We have seen that on the coins of the earlier Emperors, the same epithet is indiscriminately prefixed to the names of several towns, and that three or four diverse titles are borne by the same locality. An examination of the above list of References makes it clear that this was in accordance with the theory and practice of those times. Ahmadābād, Agrā, Dehli, Fatḥpūr, and Lāhor are all called دارالخلافت in the Histories of Akbar's reign. Four of these towns are at the same time, styled دارالسلطنت. Kābul again, has the identical appellation and is also entitled دارالملک - دارالامن - دارالنشاط - عشرت آباد and عشرت سرای. But Agra too is دار الملک, so is Dehli and this last is further honoured with the designation دار البرکت. The same thing is true of Ajmer, Kashmīr and several other places. There can be little doubt that many of these high-sounding prefixes are mere flourishes, tags or jingles coined by the authors to show off their powers of 'fine writing.' But some of them are not without their interest, especially for the student of the Historical Geography of India, and it is not impossible that a few of them were not unknown to and recognised in the State archives, and that they may be discovered hereafter on the coins.

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217. The *Laqab* 'Ṣāḥibqirān-i-Ṣānī.'

The titular adjunct *Ṣāḥib Qirān-i-Ṣānī*, which occurs on the coins of Shāh Jahān and several of his successors, has been very fully dealt with from the numismatic side by Dr. Taylor in Num. Sup. XIV (pp. 574-579). M. Drouin informs us that Tamerlane assumed this title on account of "a remarkable

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planetary conjunction" which took place during his reign, and that the event was turned to account by the court astrologers in the way of paying another "adulatory tribute to their imperial patron." (*Loc. cit.* p. 575) [1].

After his death, the title appears to have been by unanimous consent, given to him as a distinctive appellation,[2] and none of his numerous descendants during two hundred years ventured to assume it. The question then is, what led Shāh Jahān to revive it in his person at the moment of his own accession? I am not aware of any trustworthy authority for holding that the auspicious conjunction of Jupiter and Venus had actually taken place in or about 1037 A.H. (1627 A.C.). Nor will it do to say that Shāh Jahān was content to have it applied to himself in the derivative or secondary sense of 'Emperor,' 'King of Kings' or 'Kaiser.'

What then was the reason? The true explanation of the imperial motives is given in the contemporary Chronicle, called "'Amal-i-Ṣāliḥ' or 'Shāhjahānnāma.' Speaking of the arrangements made in regard to the *khuṭba* and the *sikka* (the imperial style and titles to be used in official records and on coins), the writer says :—

و کنیت آن سرور ابوالمظفر و لقب فرخنده شهاب الدین محمد صاحب قران ثانی از آن مقرر شده که تیغ جهاد آن بادشاه سلیمان دستگاه دیو فتنه و فساد از روی زمین رانده وباوجود مشابهت و مناسبت اوضاع و اطوار پسندیدهٔ آن برگزیده بحضرت صاحب قران اعظم بیذات لفظ صاحب قران که سه صد و شصت و پنج است با حروف شاه جهان مساوی آمده *

[1] Tīmūr's own account in the 'Malfūẓāt-i Timūrī' is not unworthy of attention and is quoted below: "A celebrated astrologer waited on me and delivered a plan of my horoscope, stating that at the time of my birth the planets were in so favourable and auspicious conjunction as certainly to predict the stability and duration of my good fortune and sovereignty; that I should be superior to all the monarchs of the age: that whoever were my enemies should be subdued, and whoever were my friends should be prosperous; that I should be the protector of religion, the destroyer of idols, the father of my people, that my descendants should reign for many generations, and that they should be prosperous as long as they continued to support the Muhammadan religion, but if they should deviate therefrom, their dominion would soon be annihilated. Stewart's Translation (1830), p. 13. The horoscope of Tīmūr as it was cast by the astrologers of his grandson, Ulugh Beg, is given by Hyde, 'Syntagma Dissertationis,' II, 466. See Gibbon, 'Decline and Fall,' ed. Smith, VIII, 41 note.

[2] So the Emperor Jahāngīr makes the following announcement for the benefit of his readers: "In these Memoirs, whenever *Ṣāḥib-qirānī* is written it refers to Amīr Timūr Gūrgān; and whenever *Firdūs-makānī is* mentioned, to Bābar Pādshāh; when *Jannat-āshyānī* is used to Humāyūn Pādshāh; and when '*Arsh-āshyānī* is employed, to my revered father, Jalālu-d-din Muḥammad Akbar Pādshāh Ghāzī." 'Tūzuk-i-Jahāngīrī.' Rogers and Beveridge, Trans. I, 5.

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Bibl. Ind. Text, p. 228, seven lines from foot.

"And it was settled that the patronymic (کنیت) of that sovereign should be Abū-l-Muẓaffar and his auspicious surname (لقب) was to be Ṣāḥib Qirān the Second, *because* the infidel-destroying sword of that Solomon-like Pādishāh had driven away the demons of strife and disorder from the face of the earth, and there was not only a likeness and a resemblance between his praiseworthy qualities and ways, and those of His Majesty the Great Sāḥib Qirān, but the *Baiyināt* of the word *Ṣāḥib Qirān*, viz. 365, were found to be exactly equal to the numerical value of the letters of *Shāh Jahān*." [1]

In other words, the real reason for Shāh Jahān's assumption of the title was not astrological or 'horoscopic,' but *cabalistic*, and had its origin in those fanciful notions of the occult properties of numbers which still form an important part of the magic and thaumaturgy of the East.

The *Abjad* value of the letters of شاه جهان was found equal to the *Baiyināt* of صاحب قران, and the Emperor took this providential coincidence as an infallible prognostic of his own reign proving as long and glorious as that of his ancestor, and felt perfectly justified in reviving the title in the *Khuṭba* and on the coins after a lapse of more than two centuries.

Now the *Abjad* value of شاه جهان is 365. Thus, ش = 300, ا = ا ہ = 5, ج = 3, ہ = 5, ا = ا ن = 50; 300 + 1 + 5 + 3 + 5 + 1 + 50 = 365.

But what are the بینات of صاحب قران?

There are in the books on the علم جفر twelve different modes of disjoining (تکسیر), permuting and combining the thirty letters of the Arabic alphabet for purposes of divination.[2] One of these twelve rules or methods is employed as

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[1] The corresponding passage in the *Bādishāhnāma* of 'Abdul Ḥamīd Lāhōrī is so similar that its translation would be a work of supererogation. It is therefore given below only in the original.

و بالهام لاريبي و افاضهٔ غيبي تيمنا و تبركا لقب ديگر صاحب قران ثاني اختيار فرمودند لله الحمد كه كارهاى حضرت شاهنشاهي را كه در ايام پادشاه زادگي بروى كار آمده باشدون فرازندهٔ افسر جهانبانى * * * حضرت امير تيمور صاحب قران انار الله برهانه كه پيش از جلوس سر بر زده مشابهت و مجانست تمام است و مساوات بينات صاحب قران كه سيصد و شصت و پنج است باز بر شاه جهان شاهد صدق اين مقوله است *

Bibl. Ind.' Text, I, i, 96, ll. 4-12.

[2] These rules are really derived from the Jewish Kabbalah. "According to the Kabbalah all these esoteric doctrines are contained in the Hebrew Scriptures. The uninitiated cannot perceive them; but they are

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follows. The letters are pronounced by their names (e.g. alif, bā, tā, ṣā, jim, etc.) and divided into *Zabar* and *Baiyināt* or *Baniyāt*. The initial letter of the name of each of the signs, viz. ا, ب, ت, ث, is the *Zabar*, and is cast out. The value of the remainder only, the *Baiyināt*, in the *Abjad* system of notation is taken into account.

Thus صاحب قران is made up of

صاد, الف, حا, با, قاف, را, الف and نون.

Eliminating the initials,

ص, ا, ح, ب, ق, ر, ا, and ن,

and taking the *Abjad* value of the remainder, we have

اد = 1 + 4 ; لف = 30 + 80 ; ا = 1 ; ا = 1 ; اف = 1 + 80 ; ا = 1 ; لف = 30 + 80 ; ون = 6 + 50 ;

i.e. 5 + 110 + 1 + 1 + 81 + 1 + 110 + 56 = 365.

Briefly, the Emperor assumed the title because in this numerical coincidence, "the deep-sighted saw a sign, and enquirers got a hint from above" of his reign being destined to be as glorious as that of Timūr. The reason, if it deserves to be so called, may appear to us very fantastic, but there can be little doubt as to the powerful appeal thus made to the imagination of even the most cultured persons in those times. Abūl Faẓl, for instance, lays great stress on the fact of his elder brother Faiẓī having discovered that the numerical value of the name اکبر was equal to the Abjad value of the *Baiyināt* of آفتاب (Sun).

"Among the excellencies of the name [اکبر] which is full of wonders, there is one, which my honoured elder brother,....

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plainly revealed to the spiritually-minded, who discern the profound import of this theosophy beneath the surface of the letters and words of Holy Writ. .... To obtain these heavenly mysteries, definite hermeneutical rules are employed of which the following are the most important. (1) The words of several verses .... are placed over each other, and the letters are formed into new words by reading them vertically. (2) The words of the text are ranged in squares in such a manner as to read either vertically or boustrophedon. (3) The words are joined together and redivided. (4) The initials and final letters of several words are formed into separate words. (5) Every letter of a word is reduced to its numerical value, and the word is explained by another of the same quantity. (6) Every letter of a word is taken to be the initial or abbreviation of a word. (7) The twenty-two letters of the alphabet are divided into two halves; one half is placed above the other; and the two letters which thus become associated are interchanged. By this permutation, *Aleph*, the first letter of the alphabet becomes *Lamed*, the twelfth letter; *Beth* becomes *Mem*, and so on. This cipher alphabet is called *Albam* from the first interchangeable pairs. (8) The commutation of the twenty-two letters is effected by the last letter of the alphabet taking the place of the first, the last but one the place of the second, and so forth. This cipher is called *Atbash*." (C. D. Ginsburgh in 'Encyclopaedia Britannica,' 11th ed., Art. Kabbalah).

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Abū-l-Faiz, Faizī, has brought out in various admirable writings, namely, that by *the mysterious connections of letters*, which are lofty vocables and which—whether separately or in combination —*display their influences*, it appears that the indicatory letters *Baiyināt-i-ḥurūf* of the word *āftāb* (Sun) make the number 223 and thus correspond to the numerical value of the letters of the word *Akbar*." ('Akbarnāmah,' Beveridge's Trans. I, 65; Text, I, 22.) Elsewhere he informs us that when the value of the letters in the name of *Allah* was found to be equal to the number of *Manṣabs*,[1] "the deep sighted read in it glad tidings for the present illustrious reign and considered it a most auspicious omen." (Blochmann, 'Āīn,' Trans. I, 237).

S. H. Hodivālā.

218. Bibliography of Sāsānian Numismatics.

The honour of first unveiling the mysteries hidden for many centuries in the Sāsānian inscriptions on rocks and coins belongs to Sylvestre de Sacy, one of the most eminent oriental scholars who ever lived. His 'Mémoires sur diverses antiquités de la Perse' (Paris, 1793) mark a notable epoch in the study of the monuments and coins of ancient Persia. The work in question contains five memoirs. Dr. Hyde, the celebrated author of 'Historia religionis veterum Persarum' (1700), had already made an attempt at explaining the Greek text of the inscriptions at Naksh-i Rustam, but had failed signally. He had read ΑΡΤΑΞΑΡΟΥ as ΑΛΕΞΑΝΔΡΟΥ, and consequently referred the whole inscription to Alexander (see 1st edition, pp. 519-520). De Sacy showed that this reading was incorrect, and that the king mentioned in the inscription was Ardashīr (*Artakhshatr*), the founder of the Sāsānian dynasty. After having restored the Greek text in a critical manner, he made it the starting point for deciphering one of the two texts in oriental characters, as he believed their contents to be identical. He was successful beyond expectation in his attempt, and thus laid a solid foundation for all future decipherments.

In his third memoir, he applied the results thus obtained (which however explained only a few names and titles) to the elucidation of the legends on some of the Sāsānian coins, as he found the characters and most of the words were identical with those at Naksh-i Rustam. He thus obtained the complete titles of some of the early Sāsānian kings. He read on them also correctly the names of Ardashīr (*Artakhshatr*), Shāpūr (*Shahpūhrī*), Bahrām (*Varahrān*) and Hormazd (*Aūharmazdī*); but his other readings of names were doubtful or erroneous.

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[1] The *manṣabs* or gradations of rank were theoretically, 66 in number. The numerical value of the letters of اللّٰه (1+30+30+5) is 66.

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In a subsequent *Mémoire sur le monumens et les inscriptions de Kirmanschah ou Bisoutoun, et sur divers autres monumens Sassanids* (1815) in the 'Mémoires de l'Institut Royal de France, classe d'histoire,' Vol. II, pp. 162-242, he corrected some of his previous mistakes. The results published by him, in his various memoirs, have formed the basis on which all subsequent investigations have been founded.

The first to apply these results to further researches was Sir W. Ouseley in his 'Observations on some medals and gems, bearing inscriptions in the Pahlawi or ancient Persick character' (London, 1801). By means of De Sacy's discoveries he was able to read the legends on about 23 silver coins in the Hunterian Museum, containing names already known; but the only addition he made to our knowledge of Pahlavī, was by reading, for the first time, the name of Khusrau (*Khūsrūī*) on certain coins.

In 1811 Visconti in his 'Iconographie grecque' (Vol. III, pl. 51), published several coins of the early Sāsānian kings, which he deciphered by aid of the discovery of De Sacy.

T. C. Tychsen of Göttingen in 1789 published some Sāsānian coins without providing their reading and later on wrote some articles on them (*Commentationes IV de numis veterum Persarum*, in 'Comment. Soc. Reg. Scient. Gött. rec.' Vols. I-IV, 1808-13), but he made no advance whatever; all he could do, was to apply the results obtained by De Sacy and Visconti. ('Mem. Soc. Götting.,' 2nd series, Vol. II, 1811-13), and venture on a few guesses.

Mionnet in his 'Description de médailles antiques,' (Vol. V, 1811; and Supplement Vol. VIII, 1837), profiting by the works of his predecessors, gave the meaning of the legends on coins of some kings from Ardashīr I to Shāpūr III.

In 1822 Fraehn published at Mittau an essay on the coins of the type of Khusrau II with legends in Pahlavī and in his two memoirs ('Journal Asiatique,' June 1824, Vol. III and March 1825, Vol. IV), he demonstrated that these pieces did not appertain to the Sāsānian dynasty, but were issued by the first Khalifs in conformity with the enunciation of Makrīzī. He gave at the same time the detailed description of the pieces, among which was a drachm struck by Hejaj bin Yusaf (of which the illustration is found in Vol. IV, p. 338). The reading proposed was contested by De Sacy. The honour of having opened the way of the Arab branch of Pahlavī numismatics belongs to Fraehn. He deciphered all but the Pahlavī legend, and it was Olshausen who, in 1843, read this legend *sanat hasht haftāt* (year 78).

The same journal ('Journal Asiatique,' 1823, Vol II, pp. 143-150) contains the observations of E. Rask, the celebrated Danish scholar, then in India, on the Zand and Pahlavī alphabets. He seems to have ignored the works of De Sacy as they

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are not mentioned at all. This article was communicated to De Sacy who had it printed.

In the same year Marsden in his 'Numismata Orientalia,' Vol. II, devoted some pages to the coins he possessed of the Sāsānian kings, Firōz I, Kobād I and Khusrau I.

For a long time no other scholar directed his attention to this subject. In 1840, Longpérier published a comprehensive work on the Sāsānian coins, entitled 'Essai sur les médailles des rois perses de la dynastie sassanide' (Paris), just half a century after the memoir of De Sacy. It contained the description and figures of a large number of coins struck by the Sāsānian rulers, from Ardashīr I to Yezdegerd III, that is, from the rise to the fall of the Sāsānian dynasty (A.C. 224-651). Some names hitherto undeciphered on coins, but readable without difficulty, were read by him for the first time, such as Kobād (*Kavāt*); that of Yezdegerd had already been hinted at by Tychsen; but some of his reading of names were wrong, such as Shehryar and Azermidokht. Excepting names, no fresh addition to our knowledge of Pahlavī was made by Longpérier, who had scarcely anything to guide him save the readings of De Sacy and Sir W. Ouseley. His work, however, as a collection of all the then available material, was a considerable advance in Pahlavī numismatics, and exhibits very clearly the difference, in form, of the Pahlavī characters of the earlier and later centuries of the Sāsānian rule. The author justly remarked, that there is but little difference between the characters on the later coins and those used in the MSS. His work was meritorious for the times, although it contained several errors, which were pointed out by Krafft in 1846 and by Ed. Thomas ('Numismatic Chronicle,' 1852), but they themselves in turn committed several mistakes in their rectifications.

H. H. Wilson in his 'Ariana Antiqua' (1841) published some Sāsānian coins with their description.

A decided advance in our knowledge of the inscriptional Pahlavī was made by J. Olshausen, a disciple of De Sacy at Paris from 1820 to 1823, in his pamphlet on the Pahlavī legends which are found on the coins of the later Sāsānian kings, on the earlier coins of the Khalifs, on the coins of the Ispehbeds of Tabaristān, and on the Indo-Persian coins of east-Ērān. The pamphlet is in German, and its title is: 'Die Pehlewi-Legenden auf den Münzen der letzten Sāsāniden, auf den ältesten Münzen arabischer Chalifen, auf den Münzen der Ispehbeds von Taberistān und auf den indo-persischen Münzen des östlichen Irān, zum erstenmale gelesen und erklärt von Dr. Justus Olshausen, Kopenhagen, 1843.' He may justly lay claim to have deciphered, for the first time, the legends on the classes of coins just mentioned; and he discovered names, numerals written in words, and other terms, which had not been read by any of his predecessors. On a certain class of

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coins, he read the name *Tapūristān* (the country of Tabaristān), together with some other proper names and numerals. Some of the coins had only Pahlavī legends, while others have legends both in Pahlavī and Kufic characters; some of the proper names are Arabic, others are Persian. He deciphered the term *afzūt*, which is of such frequent occurrence on the later Sāsānian coins. He also read, on the earlier Arab coins, the names of the governors.

The decipherment of the legends on Sāsānian coins now began to receive more attention from oriental scholars. B. Dorn devoted to the subject several papers which were published in the 'Bulletin de le classe historico-philologique de l'Académie Impériale des sciences de St. Pétersbourg' (Vol. I, 1844, pp. 107-110, 207-272 and 274-294). He made no fresh discoveries of any importance, but read the names, which were already known from the works of De Sacy and Longpérier on all the Pahlavī coins accessible to him. He still retained the erroneous reading BH for *bagī*, which had been proposed by De Sacy. Our knowledge of Pahlavī numismatics has, however, gained considerably by his description of coins which had not been accessible to any other Pahlavī scholar.

From this time till 1881, he published in the same journal, in the 'Mélanges Asiatiques' and in the 'Z.D.M.G.' (1867), a series of articles on Sāsānian numismatics, explaining a number of points, some of which still remained doubtful, particularly those arising from the legends on the reverse.

A. Krafft published, in 1844, a valuable review of Olshausen's pamphlet in the 'Wiener Jahrbücher für Literatur' (Vol. 106, Anzeigeblatt, pp. 1-33). The German title of this review is: 'Ueber Herrn Professor Olshausen's Entzifferung der Pehlewi-Legenden auf Münzen.' He gave some information regarding the native rulers of Tabaristān and the subsequent Arab governors of the province, and the different dynasties to which they belonged; and especially endeavoured to settle their chronology, by aid of the coins on which numbers referring to an era are found, placing the commencement of this era in A.C 645. He likewise deciphered the legends on the Pahlavī coins of the Vienna collection.

The result of the works of Olshausen and Krafft was to fix in a definite manner the method of reading the Pahlavī of the Arab epoch such as is figured on the numerous coins which were struck during the first two centuries of the Hijra.

The importance of the discovery of Olshausen did not escape Fr. Soret, an orientalist of Geneva. In a letter addressed to the German savant dated the 24th of December, 1846, he expressed his admiration and at the same time published new pieces of his own which he deciphered by aid of the indications of Olshausen.

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In 1846 Savelief published some remarks on the coins of Tabaristān with Pahlavī legends.

It appears that the discoveries of Olshausen, whose pamphlet had been translated into English by Wilson ('Numismatic Chronicle for 1848,' Vol. IX) induced E. Thomas, of the Bengal Civil Service, to investigate the Pahlavī coins of the earlier Arab rulers. He published a very comprehensive essay on this subject, in the 'Journal of the Royal Asiatic Society for 1850' (Vol. XII, pp. 253-347). As the material at his disposal was more extensive than that used by Olshausen, he was able (aided by the latter's discoveries) to make a further advance in the decipherment of the legends on the later Pahlavī coins. He described, (*a*) the coins of 'the purely initiative, imitative, coinage of the Arabs, from A.H. 18 to 43', during which period the Arab conquerors used the coins of the later Sāsānian kings, or struck coins with similar dies, bearing Pahlavī legends, merely with the addition of the words بسم الله; (*b*) the coins of the Arab governors of the first century of the Hijra era, down to Hejaj bin Yusaf (A.H. 81). He also showed that these later coins bore the names of the mint cities, on the right side of their reverse; and he tried to identify some of these names. Whether this was an independent discovery of Thomas, or whether it was suggested by the remarks of Mordtmann to the same effect, does not clearly appear; suffice it to say, that Mordtmann's note on the subject appeared in 1848 ('Zeitschrift der Deutschen Morgenländischen Gesellschaft,' Vol. II, p. 112), whereas Thomas's essay was read in June 1849. He likewise added a valuable note 'regarding the unidentified characters composing the legends on certain classes of Sassanian coins.' Some of these coins which are depicted in Wilson's 'Ariana Antiqua,' had from their singularity (as they also bear Indian characters), already attracted attention; but the honour of having first more minutely examined them, belongs certainly to Thomas. He traced some of these coins more fully in a separate note to his edition of Prinsep's 'Essays on Indian Antiquities,' 1858 (Vol. II, pp. 107-116); and in the same edition, he has made several other scattered remarks on Pahlavī coins (Vol. I, pp. 12-15, 32-35, 62-72, 93-96 and 120-126). He also contributed a series of articles to the 'Journal of the Royal Asiatic Society' (1868 and 1872) and the 'Numismatic Chronicle' (1850, 1852, 1872 and 1873) as a basis for a more extended 'Essay on Sassanian Coins' at that time in preparation for the *International Edition* of Marsden's 'Numismata Orientalia,' but unfortunately it never came out.

In all his writings, Thomas shows himself to be a skilful palaeographer, who could identify characters which are difficult to read; but in his philological explanations he is not very successful.

Whilst attempts were made to investigate the language of

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the Pahlavī books by Müller, Westergaard and Spiegel, the legends on coins were by no means neglected.

The most important and complete works on Sāsānian numismatics and the Pahlavī coinage of the Arab governors of Persia are those of Dr. A. D. Mordtmann of Constantinople. All his memoirs appeared in the 'Zeitschrift der Deutschen Morgenländischen Gesellschaft.' The first two are of the years 1848 and 1850 in the form of letters to Olshausen. The German savant proposed for the first time to explain by the names of towns certain legends which are found on the reverse of the coins and thus he determined thirty-mints. In 1854 he published a most comprehensive and valuable essay on the coins with Pahlavī legends, entitled 'Erklärung der Münzen mit Pehlevi-Legenden' in the 'Z.D.M.G.,' Vol. VIII, pp. 1-194. He divided them into four classes: (*a*) Sāsānian coins (A.C. 224-651); (*b*) the older Muhammadan pieces coined by the Arab governors (down to A.C. 700), with legends in Pahlavī and Kufic characters; (*c*) coins of the rulers of Tabaristān (down to A.C. 800); (*d*) coins of the eastern provinces of Persia, which exhibit Devanāgrī and other characters, which are unintelligible, besides the Pahlavī. The material at his disposal was the most extensive that had been available to any scholar; for he states that he had been able to examine about 2,000 Pahlavī coins, ranging from the time of Ardashīr Bābegān, down to the latest coins with Pahlavī legends, struck under the Arab rule. His researches extended however, only to the first three classes of coins; the fourth, or so called Indo-Sāsānian class, which is most difficult to handle, he does not appear to have examined.

The legends on the coins are divided by him into eight classes, which follow one another almost in chronological order. Here it need only be observed that at first the name of the king with all his titles appeared on the obverse, while on the reverse the name was repeated with the addition of some other word. This repetition alone enabled De Sacy to decipher the legends on the earlier Sāsānian coins, as the same names and titles appear in almost the same form. In the course of time (from Bahrām IV, A.C. 388-399) the titles were shortened, and frequently only *malkān malkā*, 'king of kings,' was used. On those of Firōz I (A.C. 459-484) even this title was omitted, and merely the name was given, with some benedictive formula, such as *afzūt*, and this custom was continued till the end of the Sāsānian rule.

From a palaeographic point of view, that is, as regards the shapes of the Pahlavī characters, he divided the coins into three periods: (*a*) those whose alphabet is identical with that used in the rock inscriptions (from Ardashīr I to Narses, A.C. 224-303); (*b*) those whose letters are intermediate in form, between the lapidary alphabet and that of the books (A.C. 303-

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600) ; (*c*) those whose alphabet is identical with that of the books (A.C. 600-800).

Notwithstanding the extent of his material Mordtman did not rest satisfied with his researches ; but, deeply interested in the subject he sought for and examined 3,000 more coins in addition to the 2,000 previously mentioned. His further investigations, the aim of which was to complete and rectify his former efforts, were published in two subsequent articles, in the 'Journal of the German Oriental Society (Z.D.M.G.)' for 1858 and 1865 (Vol. XII, pp. 1-56 and Vol. XIX, pp. 373-496). He also wrote an essay, in which he explained the Pahlavī inscription on seals, entitled 'Studien über geschnittene Steine mit Pehlevi Inschriften,' in the 'Z.D.M.G.,' Vol. XVIII, of 1864, pp. 1-47 ; see also Vol. XXIX of 1875 and Vol. XXXI of 1877.

His results, so far as they went beyond those obtained by De Sacy and Olshausen, were contested, especially by B. Dorn ('Mélanges Asiatiques,' St. Petersburg, Vol. III, of 1858-59, pp. 149-165, 426-459, 460-475 and 502-531), Bartholomaei ('Mélanges Asiatiques,' Vol. III, pp. 139-165 and 349-372 ; and 'Bulletin historico-philologique,' Vol. XIV, pp. 371-378) and Khanykov (in a letter to B. Dorn), who seem to represent the Russian branch of Pahlavī numismatists. They specially objected to his explanation of certain words and abbreviations on the reverse of the later coins, as the names of the mint cities ; also to the treatment of the Kobād and Khusrau coins, etc. But although the observations of Dorn contain much valuable matter, and even some real corrections of Mordtmann's readings, the latter is right as regards the mint cities. His opponents are undecided how to read the words and signs which he so interprets. They suppose that they may be the names of the die cutters, or signs indicating the value of the coin or honorific epithets ; but all these opinions seem groundless, and have been very ably refuted by Mordtmann ('Z.D.M.G.,' Vol. XIX, pp. 373-413).

Notwithstanding the objections raised against his treatment of Pahlavī numismatics, no impartial scholar can deny that Mordtmann has greatly advanced our knowledge of this branch of antiquarian research and justice must be done to him for his persistent efforts in unravelling the reading of the mints. His judgment is sound, his oriental scholarship and aquaintance with the Byzantine, Arab, Persian and Armenian historians (who are the chief sources of information regarding the Sāsānian kings) is very considerable, and his zeal is indefatigable.

Stickel in the second part of his 'Handbuch zur morgenländischen Münzkunde' (1870) and in the 'Z.D.M.G.' (1870, p. 636) devoted several pages to the Arabo-Pahlavī coins and to some uncertain coins struck in Sogdiana during the Sāsānian period.

The best collection of plates of Ṣāsānian coins is that pub-

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lished by B. Dorn (St. Petersburg, 1873), entitled ' Collection de Monnaies Sassanides de feu le Lieutenant Général J. de Bartholomaei,' but unfortunately no text accompanies the 32 plates. The soldier savant had proposed to edit his collection of Sāsānian coins and announced in concert with Dorn the preparation of a *Thesaurus numorum Sasanidicorum ;* but owing to diverse causes this work unfortunately could not be undertaken and Bartholomaei died in 1870 leaving only the engraved plates which furnish us with very valuable and important information from the point of view of history, palaeography, philology and art. The historian has under his eyes a successive and almost complete list of the Sāsānian kings ; even Pāpak, the father of Ardashīr, the founder of the Sāsānian dynasty, is not missed. The different epochs of the Pahlavī alphabet can be followed for more than four centuries (A.C. 224-651). The philologist will profit by reading the legends which contain the attributes of the kings and other Pahlavī words, as well as the Pahlavī numbers from one to forty-eight. The artist also will find much of considerable interest. These plates will always serve as a guide and will be an indispensable manual for those who are interested in Sāsānian numismatics.

Mordtmann having replied (in the ' Z.D.M.G.' for 1858 and 1865) to several criticisms made by Dorn, Bartholomaei, Nöldeke and Salemann on certain readings of dates and proper names, resumed the question of the mints in a subsequent paper published in the ' Z.D.M.G ,' Vol. XXXIII, for 1879, pp. 113-136. In the same volume (pp. 82-112) he also gave a complete treatise on the numismatic history of the Arab governors of Persia, with the determination of four eras, of Yezdegerd, of Khusrau, of the Hijra and of Tabaristān employed on their coins.

In his posthumous memoir, in the ' Z.D.M.G.' 1880, Vol. XXXIV, pp. 1-162, which is wholly devoted to the royal Sāsānian coins, the earlier essays have been brought up to date.

According to Drouin the essays of Mordtmann combined with the plates of Bartholomaei, should be used still as the basis of all Sāsānian studies.

The first published catalogue of Sāsānian coins is that by A. de Markoff (1889), describing about 500 coins of the Sāsānian series in the cabinet of the *Institut des Langues Orientals* at St Petersburg.

Sir A Cunningham has published some rare Sāsānian coins in the ' Numismatic Chronicle ' for 1893, p. 178, pl. XIII.

Several papers have been contributed by E. Drouin on Sāsānian numismatics, of which the three important ones are : ' Observations sur les monnaies à légendes en pehlvi, in the Revue Archéologique ' for 1884 and 1885 ; ' Histoire de l'Epi-

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graphie Sassanide (Aperçu sommaire ; mémoire lu à la section Iranienne du Congrès des Orientalistes tenu à Paris en Septembre 1897) ' ; and ' Les Légendes des Monnaies Sassanides in the Revue Archéologique, 1898.' The first treats of Pahlavī numismatics generally and the second gives a bibliography of the publications on Sāsānian matters, including the coins. This bibliography is almost similar to that given by A. de Markoff in his catalogue of Sāsānian coins above mentioned. In his third paper Drouin gives the amended readings of all the Sāsānian coin legends.

E. J. Rapson has described a few Sāsānian coins collected in Sīstān by G. P. Tate of the Sīstān Boundary Commission in the ' Journal of the Royal Asiatic Society ' for 1904, pp. 673-86 and 1 pl.

The only other catalogue of Sāsānian coins, describing about 73 coins in the Indian Museum at Calcutta, is by Vincent Smith (' Catalogue of the Coins in the Indian Museum, Calcutta,' 1906, Vol. I, pp. 217-229 and pl. XXIV).

The most notable addition in recent years to our knowledge in this branch of Sāsānian antiquarian research is the essay by J. de Morgan, entitled ' Contribution a l'étude des ateliers monetaires sous la dynastie des Rois Sassanides de Perse ' (*Revue Numismatique*, 1913). This essay deals entirely with the Sāsānian mints. De Morgan has thrown fresh and interesting light not only on the known mints but also on several hitherto unknown mint-monograms. It is a comprehensive work full of all the latest researches and reveals a rare and vast knowledge of places personally visited and examined. In fine it is a scientific exposition not only of the many ambiguous readings of the mint-monograms, but also of most of the identifications laid down hypothetically by earlier authors.

A few notes by myself on some rare Sāsānian coins will be found in the ' Numismatic Supplements ' XXVIII and XXIX to the ' Journal of the Asiatic Society of Bengal,' Vol. XIII of 1917 ; and *N.S.* XXX to the *J.A.S.B.*, Vol. XIV of 1918.

Dr. G. F. Hill, the Keeper of coins and medals in the British Museum, informs me that J. de Morgan has in an advanced stage of preparation a complete account of the whole subject of the Sāsānian coinage. The casts of all Sāsānian coins in the British Museum had already been supplied to him. His MS. and plates are almost ready for publication, and his material is likely to be more complete than any at the command of previous students.

He also informs me that W. H. Valentine has in preparation (and far advanced) a brief general guide to Sāsānian coins.

Mr. Nelson Wright informs me that De Morgan is not likely to complete his work for an indefinite period.

In the preparation of these notes and bibliography the following works have been of great assistance :—

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Haug's 'Essay on Pahlavī';
De Markoff's 'Catalogue des monnaies Sassanides'; and
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* * * * * 'Seltene sassanid. Münzen. Mit. Abb.'
Gartenlaube, 1908, p. 1092 sq.

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(1. Goldmünze d, Sassaniden königs Varanes III; 2. Goldmünze d, königin Purandocht. D. Aufschriften beider sind in Pehlewi).

This paper is mentioned in the Jahresberichte der Geschichtswissenschaft, XXXI (1908), Perser, E. Wilhelm, p. I, 33, no. 111; but the names of the author and the journal are not given.

It appears from the Orientalisch Litteratur Zeitung, 11, pp. 48 and 257 that a gold coin of Bahrām III was presented to the Royal Museum of Berlin in 1907. Perhaps it is the same as described above.

FURDOONJEE D. J. PARUCK.

25*th June*, 1919.

219. MINT TOWNS OF THE DEHLI SULṬĀNS.

In imitation of the admirable example set by the compilers of the catalogues of Mughal coins in the Calcutta and Lahore Museums I have extracted the following notes from a mass of material collected for private reference, in the hope that they may be of use to others, and encourage collectors to assist in the completion of a list which does not pretend to be exhaustive in any way. Much has yet to be learned regarding the provincial mints of the earlier rulers, and the list of Sūrī mints is still far from complete. Save in a few cases which are supported by historical references, I have ignored purely conjectural references. Many mints have been suggested which are not in the list, but they yet need definite proof, and possibly their omission may incite the propounders of these suggestions to establish their theories by irrefutable evidence.

Ābu.

This is believed to be a copper mint of Sher Shāh, who obtained possession of the celebrated hill fortress through the agency of Khawāṣ Khān. It had belonged formerly to Rāja Māl Deo of Jodhpūr. The mint was long unrecognized, owing to the similarity of the name to Alwar, but the coins of the two places differ slightly in detail, those attributed to Ābu being peculiar, at all events in the issues of 951, in having the date both on the area and on the margin of the obverse. There is no reason to believe that this mint continued to work after the death of Sher Shāh in 952.

Āgra.

A small copper coin attributed to Altamsh was struck at some town whose name might be read as Āgra, but no mention of this place occurs in history until its foundation, or possibly

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its restoration, by Sikandar Lodī, who made Āgra his capital and abandoned Dehli. The name does not appear on the coins of Sikandar Lodī or his successor, but both Bābar and Humāyun made Āgra a mint for silver and copper. From the capture of the city by Sher Shāh in 947 the numismatic importance of the place increased. Sher Shāh, Islām Shāh and Muḥammad 'Ādil struck silver rupees here, though the name appears on the copper coinage only of the first of these monarchs. Issues of Ibrāhīm and Sikandar, both of whom held Āgra for a time, have not been discovered.

Alwar.

A mint for copper coin was established at Alwar by Sher Shāh, 950 being the earliest known date. The mint was maintained by Islām Shāh, who also struck rupees here.

Awadh.

This, the ancient Ajodhya, was first discovered by Mr. Nelson Wright to have been a Sūrī mint. The coins issued from Awadh are not represented in any public collection and are of copper only. Dāms and half-dāms were issued by Islām Shāh, and a doubtful reading gives a dām of Sher Shāh also.

Bhānpūr.

The modern Bhānpūra takes its name from a hill fortress in the Indore State near the right bank of the Chambal. A few rare rupees of Sher Shāh bear a name read by Thomas as Bhānpūr, but no reference to the place is to be found in the historians. If the reading is correct, a mint must have been established here in 950 by Sher Shāh as a post on the road from Rantambhor to Ujjain; but though the name has not been determined with sufficient certainty, no more satisfactory reading has yet been suggested.

Biāna.

The old stronghold of Biāna became a mint for copper under Sher Shāh, and the dāms here struck are of a characteristic type. In the reign of Islām Shah the mint produced rupees of two types, but his copper coins have not yet been recognized with certainty.

Bilādu-l-Hind.

This term, signifying merely 'the cities of India' appears on a few coins of Altamsh and his immediate successors. It indicates no mint, but as it is combined with Lakhnautī in a coin of Nāṣiru-d-dīn Maḥmūd, it may be presumed that it was

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applied generically to the country of Hindustān and included Bengal.

Bud Hāndia (?).

Numerous copper coins, both dāms and half-dāms of Islām Shāh, of a very distinctive and unusual type, bear a mint-name which has long been a subject of speculation. Dr. Hoernle suggested Ludhiāna, but this is clearly untenable, for the second portion of the name is obviously هاندیه. The first portion, provided there are no letters omitted from the beginning, is بود or more probably بول. The design of the coin is so different from that of any other issue by the same Sulṭān that it may well be regarded as provincial.

The most probable suggestion is that the Hāndia of these coins is the modern Handia in the Hoshangābād district. Handia has the remains of an old fort, built in the days of Sher Shāh, and commands one of the most frequented passages of the Narbada, on the main route from Ujjain to Burhānpūr. It is described as an ancient Hindu town founded by Rājā Bhoja Deva Panwār, and Sher Shāh gave it with Sewās in *jāgīr* to Shujā'at Khān, who subsequently held Ujjain, Māndū and Sārangpūr. At a later date Handia was transferred to the *jāgīr* of Bihār Khān Sarwāni, and in the days of Humāyun the *jāgīrdar* was Mehtar Zambūr, who was driven out and compelled to take refuge at Ujjain by Sikandar Khān and other insurgents.

The place reappears frequently in later history and was the seat of a *faujdār* so long as it remained in the possession of the Mughals, while under the Marāthās it was the headquarters of an *'āmil*.

It is clear that the town was of importance and in the days of the Sūrī Sulṭāns it constituted the southernmost fortress of the empire.

The name is given as Hāndia by the author of the 'Muntakhabu-l-lubāb,' and it is unnecessary to lay too much stress on the quantity of the initial syllable.

The name Būl or Būd presents a greater difficulty, but possibly this may be an abbreviation of the full name Handia Bulang Shāh, the place being named after a saint whose tomb is still honoured.

The identification is not certain by any means, but at least it is as plausible as any other which has been put forward hitherto.

Chunār.

The ancient stronghold of Chunār came at an early date into the hands of Sher Shāh, but no coins of this mint earlier than 949 have yet come to light. Silver and copper were minted here by Sher Shāh, Islām Shāh and Muḥammad 'Ādil.

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Dāru-l-Islām.

This mint appears first on the coins of 'Alāu-d-dīn Muḥammad and thereafter occurs till the middle of the reign of Muḥammad bin Tughlaq. It is generally regarded as a synonym for Haẓrat Dehli, but coins of both mints appear regularly in the same years and there is often a marked difference in their design and in the style of execution. The earliest coins known which bear this name are of 702, and it is suggested that the establishment of a second mint at Dehli dates from the time when 'Alāu-d-dīn Muḥammad removed his capital from Old Dehli to his new city of Sirī, which was entitled Dāru-l-Khilāfat. The College founded by Altamsh at the back of the Jāmi' Masjid of Old Dehli, and restored by 'Alāu-d-dīn, is frequently called Dāru-l-Islām, and it is quite probable that the valuable right of striking coin was left to the religious foundation after the removal of the Court from that immediate neighbourhood.

Daulatabad, see *Deogīr*.

Dehli.

The capital city of the Sulṭāns was naturally their chief place of mintage, and Dehli, with the epithets of Haẓrat or Dāru-l-mulk, which appear to have been used indiscriminately, at all events from the days of Muḥammad bin Tughlaq onwards, appears on the coins of all the kings from Altamsh to Sikandar Lodī. The latter moved his capital to Āgra, and after 908 the name of the capital vanishes from the coinage until it was restored by Humāyūn. Sher Shāh struck coins at Shergadh 'urf Haẓrat Dehli, the place of mintage being his fort of Shergadh, begun by Humāyūn and completed by himself. Rare coins of the first year of Islām Shāh bear the name of Dehli, but thereafter none are known till the return of Humāyun, unless, as has been suggested, the Shāhgadh of Islām Shāh and Muḥammad 'Ādil refers to the imperial capital.

Haẓrat Dehli or Dehli Dāru-l-mulk refer to Old Dehli till the days of 'Alāu-d-dīn Muḥammad and his foundation of Sirī. Possibly the royal mint was moved to Tughlaqābād for the short time during which that fortress was occupied, but thereafter it remained at Sirī or Fīrozābād according to the inclination of the ruler, until the days of the Sūris.

See also Dāru-l-Islām and Jahānpanāh.

Deogīr.

Qila' Deogīr first appears as a mint of the Dehli Sulṭāns in the reign of 'Alāu-d-din Muḥammad. It is doubtful if any coins were struck here before 714, although the fort was taken in 709. Issues of gold and silver are known of Alāu-d-dīn

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Muḥammad and Ghiāṣu-d-dīn Tughlaq. It is probable that the gold coins of Qutbu-d-dīn Mubārak struck at Quṭbābād in 718 and 719 are really coins of Deogīr, the name of Quṭbābād commemorating the recapture and rebuilding of the fortress by that monarch. Deogīr was a mint of Muḥammad bin Tughlaq and his gold dinārs give the place the title of قبة الاسلام اعني حضرة دیوگیر.

The place was also named Daulatābād by Muḥammad bin Tughlaq, who undertook the disastrous experiment of transferring his capital thither from Dehli in 740. The change was shortlived, for in the following year Dehli again became the recognized seat of government. It is curious to find the name of Daulatābād employed on the posthumous gold and silver coins of Ghiāṣu-d-dīn Tughlaq struck in 725 and 726, as in the three succeeding years the name of the mint reverts to Deogīr, while on the brass tokens of 730 and the following years we find Daulatābād, this name making infrequent reappearances thereafter.

Dhār.

The mountain stronghold of Dhār in the country of Mālwa received abundant attention from the Sulṭāns of Dehli, but no mint was established there till the days of Muḥammad bin Tughlaq, who struck large numbers of brass *tankas* at Darra Dhār, the pass of Dhār, sometimes misspelt Dāhār on these coins. The place was occupied by the Sūrīs, but no mint appears to have been established there.

Fakhrābād.

This is the suggested reading of a mint which appears on a solitary copper coin of Ghiāṣu-d-dīn Balban, published by Mr. Whitehead. The position of the place is not known, and it must be included among the questions which still await elucidation with regard to the mint-towns of this Sulṭān.

Faṭhābād.

This name first appears as a mint on the coins of Jalālu-d-dīn Muḥammad, Sulṭān of Bengal from 817-835.

Coins were struck here as early as 946 by Sher Shāh and it continued to issue rupees throughout his reign. No later rupees are known and it would seem that the mint was closed by Islām Shāh.

The place is now known as Farīdpūr and gives its name to a district in Bengal.

Gaur.

A mysterious rupee of Shamsu-d-dīn Altamsh bears a mint which resembles بکور and this has been read as ba-Gaur. A gold coin published by Thomas has the words ضرب بکور and a

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similar interpretation has been given. An alternative reading is Nagor, but this place is invariably written Nāgor. The problem has not been solved, but in any case Gaur is unlikely, as we are told that the name was changed from Gaur to Lakhnautī before the days of Altamsh. A close examination of the rupee in the Indian Museum convinces me that the mint is Laknautī; but the gold coin, as reproduced by Thomas, cannot be so read.

Gwāliar.

The renowned fortress of Gwāliar became, apparently for the first time, a place of mintage in the reign of Sher Shāh, into whose possession it passed in 947. Thereafter the mint was used very largely by that Sulṭān and his successors, Islām Shāh and Muḥammad 'Ādil, both silver and copper coins being issued in profusion. The copper coins of Islām Shāh, however, are rare, and the two types of *dāms* struck by Muḥammad 'Ādil are not common.

Ḥiṣṣār.

The town and fortress of Ḥiṣṣār was founded by Fīroz Shāh, but the place does not appear as a mint till the days of the Sūrī dynasty. It was the birth-place of Sher Shāh, and possibly on this account it rose to greater prominence when that great monarch incorporated it in his wide dominions. Only copper issued from this mint and, as far as is known, it ceased working at the end of his reign, no coins of Islām Shāh having yet come to light.

In the catalogue of the White King collection reference is made to a billon coin of this mint issued by Muḥammad bin Tughlaq, but the coin is not illustrated and the reading needs confirmation.

Jahānpanāh.

The portion of the triple town of Dehli known as Jahānpanāh, which occupies the space between Old Dehli and Sirī, was founded by Muḥammad bin Tughlaq. The name never appears on coins, however, till the days of Sher Shāh. Thomas at first considered the word to be a mere title of the Sulṭān, but subsequently he changed his mind and regarded it as the name of the mint abruptly inserted. His view has been adopted by subsequent authorities, including Mr. Nelson Wright, who regard it as the name of the Dehli mint, presumably by analogy from the fact that the new city built by Humāyūn, and completed by Sher Shāh under the name of Shergadh 'urf Ḥaẓrat Dehli, was styled by the former monarch Dīnpanāh.

Now no historical reference can be found to Dehli under the name of Jahānpanāh during the reign of Sher Shāh. On the contrary we have coins bearing this word and dated in

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946, while those of 947 are very numerous. Sher Shāh did not gain possession of Dehli till the end of 947, and he is not likely to have struck coins bearing that mint-name before it was included in his dominions. Again with very few exceptions, such as the Sharifābād coins of the earlier type, the mint is always prefaced by the word *ẓarb*, and this never occurs before Jahānpanāh. Further, the rupees of Ujjain bear the words *ẓarb Ujjain* on the obverse margin, whereas on the reverse the honorific title of the sovereign is Abū-l-Muẓaffar Jahānpanāh; a fact which shows conclusively that Jahānpanāh in this instance cannot be anything but an honorific epithet. Contemporary histories show that the Sūrī Sulṭans and Akbar were commonly addressed by this term, and this, in conjunction with the other evidence adduced, tends to show that in the case of Mr. Thomas second thoughts were unfortunate and that definite authority for the inclusion of Jahānpanāh among the mints of the Pathāns is still lacking.

Jaunpūr.

We are told in the 'Tārīkh-i-Mubārak Shāhī' that Fīroz Shah founded a new fort and city at Jaunpūr by the name of Ẓafarābād and that he installed his son Fatḥ Khān as viceroy of the eastern portions of his dominions with the right to coin. The issues bearing the name of this prince are clearly of a provincial type, as pointed out by Thomas, but while it is almost certain that they were struck at Jaunpūr, there is no mention of the place of mintage in the description. The Sharqī dynasty similarly omitted the name of their capital in the abundant issues of coins from their mint, and the name does not appear till the conquest of Jaunpūr by Bahlol Lodī, who struck small coins with the mint given as Shahr Jaunpūr. After him came the luckless Bārbak, but Sikandar Lodi did not continue the practice. Jaunpūr was a mint of Bābar and Humāyūn, and was adorned with the title of Khiṭa-i-mutabarrak. The place fell at an early date into the hands of Sher Shāh, but none of his known coins bear this name. Copper was struck there, however, by Muḥammad 'Ādil, who retained Jaunpūr till shortly before his death.

Jhūsi.

The small town of Jhūsi is situated opposite the fort of Allahābād on the north bank of the Ganges. It figures as a mint on a rare rupee of Muḥammad 'Ādil, and on some similar gold pieces which are not above suspicion.

Kālpī.

The old Muhammadan stronghold of Kālpī on the Jumna did not attain the dignity of a mint-city until the days of

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Sher Shāh, who from 948 onwards struck both silver and copper coin there. His example was followed by Islām Shāh and Muḥammad 'Ādil, but the silver coins of the latter are very scarce. The mint was retained by Akbar, whose Kālpi coins bear a very close resemblance to those of the Sūrī type.

Lāhor.

This great city appears to have possessed a mint only in the days of Altamsh and afterwards at the extreme end of the Pathān period, when rupees were struck here by Sikandar Sūr, before his overthrow by the forces of Humāyūn. The latter had established a mint here during the first part of his reign, but Sher Shāh appears to have neglected the place altogether, confining his attention to the great chain of forts extending along the frontier from the hills to Multān.

Lakhnau.

The present capital of Oudh is an ancient city, but it did not rise to much importance till the days of Sher Shāh, who established there a mint for copper coins. These are not particularly common, and none have yet been found of Islām Shāh or his successor.

Lakhnauti.

The famous city of Gaur under the name of Lakhnantī, written Laknautī till the days of Ghiāṣu-d-dīn Balban, was the Muhammadan capital of Bengal from the time of Quṭbu-d-din Aibak, who entrusted the eastern province to Muḥammad Bakhtiār Khiljī. This chieftain is said to have destroyed Nuddea and to have made Laknautī his headquarters, striking coin in his own name.

Shamsu-d-dīn Altamsh in 622 secured Lakhnautī for himself and struck coin there. Among his successors, rupees from this mint are known of Raẓia, Nāṣiru-d-dīn Maḥmūd and Balban. The last changed the name on the coins from Laknautī to Khiṭa Lakhnautī, the alteration occurring in 667. After the death of Balban a separate kingdom of Bengal was formed, and Lakhnauti ceases to appear on the coinage of the Dehli Sulṭāns till its recovery by Muḥammad bin Tughlaq. This monarch struck gold, silver and brass at Shahr Lakhnautī from 727 till 735, after which date the Bengal ruler appears to have regained his independence. The mint on the brass issues of 731 is styled Iqlim Lakhnautī.

See also Gaur.

Malot.

The frontier fortress of Malot, near Rāwalpindi, was built by Tātar Khan Yusufkhel in the days of Bahlol Lodi and was included by Sher Shāh in his chain of permanent works, which were afterwards strengthened and extended by his son. Both

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Sher Shāh and Islām Shāh maintained a mint for copper coins at Malot, and a few silver issues of the former are known.

Mulk-i-Tilang.

This reading has been much disputed, but is now accepted as the place at which a rare type of gold coin bearing the name of Ghiāṣu-d-dīn Tughlaq was struck. These coins were the product of the expedition led by his son Fakhru-d-dīn Jūnā, better known as Muḥammad bin Tughlaq. As no town is specified, it is presumed that the issue occurred during the first siege of Warangal, afterwards styled Sulṭānpūr (q.v.) by its conqueror. The name reappears in 725H. on the posthumous gold and silver coins of Tughlaq.

Multān.

Copper coins attributed to Altamsh, but bearing no name of the ruler, were struck at Multān. Thereafter the place disappears from the coinage till the days of the Mughal Empire.

Nāgor see *Gaur.*

Nārnol.

This town had from the first a close connection with the Sūrī dynasty, as Ibrāhīm Khān, the grandfather of Sher Shāh, died here, after having held a *jāgīr* in that neighbourhood for many years. Possibly owing to this connection, but more probably on account of the copper mines in the vicinity, Sher Shāh established a mint here, which produced copper coins in great abundance. His successor, Islām Shāh, also minted rupees at Nārnol, and this example was followed by Muḥammad 'Ādil, at all events in the first two years of his reign. The commonest type of dām issued by the latter Sulṭān came from this mint, and the execution corresponds very closely with that of the coins here produced by his predecessor, but the name very rarely appears in the inscription, and even then is little more than fragmentary.

Patna.

The location of a mint at Patna before the days of the Mughals is at least doubtful. It has been suggested that the mint-name on a coin of Fatḥ Khān, the son of Fīroz Shāh, can be read Shahr Patna, but this is mere conjecture, and further it is questionable whether Patna was a city of any importance at that period. Its rise dates from the foundation of the fort by Sher Shāh in 948, for which see Rasūlpūr.

Qanauj.

See Shergadh 'urf Qanauj and Shāhgadh.

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Quṭbābād.

The mint of Qila' Quṭbābād appears only on gold coins of Quṭbu-d-din Mubārak and in no case before 718. Hitherto it has been supposed that this was merely a name given to Dehli, but as the capital styled in the earlier issues of that king Ḥaẓrat Dehli or Dāru-l-Mulk Dehli became in 718 Ḥaẓrat Dāru-l-Khilāfat, it is more reasonable to look elsewhere. In 718 Quṭbu-d-din proceeded southwards in consequence of insurrections. We are told that he recaptured and restored the fort of Deogīr, in which he erected a great mosque. It would be only in keeping with the character of this vainglorious monarch to assume that he gave his own name to the town bearing a Hindu appellation which had for a time the honour of sheltering the self-styled Khalifa of Islām.

Rāisīn.

The fortress of Rāisīn in Mālwa was captured by Sher Shāh in 950, this exploit being accompanied by a shameful massacre of the garrison after capitulation on terms. A mint was established here for silver and copper, and this was maintained by Islām Shāh, after whose death the place was lost to the Dehli kingdom and incorporated in Mālwa by Bāz Bahādur.

Rantambhor.

The celebrated fortress of Rantambhor was captured by Shamsu-d-dīn Altamsh, and thereafter it appears frequently in the annals of the Dehli Sulṭāns. It did not, however, take its place among the mint cities of the empire till its capture by Sher Shāh in 949. It was then assigned in *jāgīr* to his eldest son, 'Ādil Khān, but its history as a mint appears to have been brief. The rupees of Rantambhor are very scarce, and no copper coin has yet been published. Coins of Islām Shāh from this mint have never been reported.

Rasūlpūr 'urf?

A rare rupee of Sher Shāh was struck at Rasūlpūr, a place which is unmentioned in the histories, and unfortunately cannot be determined by the alternative name, as this has never been read with certainty. Mr. Nelson Wright suggests Patna, and this is at least a possible reading. We know that Sher Shāh built the fort of Patna, which in consequence became one of the largest cities in the province and by its rise caused the ruin of the old town of Bihār. This occurred in 948. There is a Rasūlpūr less than twenty miles upstream from the modern town of Patna, known as Rasūlpūr Maner. The situation of this place agrees better with the account given in the

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Tārīkh-i-Dāūdī than Patna as it now stands, so that probably the fort of Sher Shāh was considerably above the town of Patna and nearer the present cantonment of Dānāpūr, if not actually situated there.

Rohtās.

See Shergadh. It is very doubtful whether Sher Shāh, who undoubtedly stored his treasure in this fortress, struck any coin here. One dām of 951 might be read as issued from the Rohtās mint, but the reading is most uncertain and in view of the close proximity of Shergadh the theory must be abandoned until definite proof is forthcoming.

Sāhat-i-Sind.

This curious appellation appears on rare billon coins of Fīroz Shāh and commemorates the period when he and his army were lost in the desert of Sind during the futile expeditions against Tatta. The coins are undated and constitute merely a camp mintage.

Sambhal.

The ancient Hindu town of Sambhal in Rohilkhand had long been the headquarters of a province, but no coins were struck there till Sher Shāh established a mint for copper, probably in 950. Both dāms and half-dāms of this ruler are known, but only one of Islām Shāh has yet come to light, although Sambhal formed his temporary capital for a considerable period. Ibrāhīm Sūr also made Sambhal his headquarters during his struggle for supremacy, but none of his rare coins record this mint.

Satgāon.

Satgāon or Satgānw appears as a mint for the first time in the days of Muḥammad bin Tughlaq, who issued therefrom gold, silver and brass coins from 727 to 735. The place is sometimes called 'Arṣat Satgānw, but there is no reason for differentiating between the district and the town.

The mint was maintained at intervals by the Sulṭāns of Bengal, and was revived by Sher Shāh, as far as can be ascertained, in 950. Two types of rupee struck by Islām Shāh are known, and the mint was working till the end of his reign,

Shāhgadh.

The position of this place is not known. It has been suggested that it is either Dehli or Shergadh (q.v.) The mint is represented by dāms and half dāms of Islām Shāh, from 958, and of Muḥammad 'Ādil. There is a Shāhgadh in the Bareilly district, which tradition ascribes to Islām Shāh, but it is very doubtful whether this small fort ever attained the importance of a mint.

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A more probable suggestion is that the name of Shergadh 'urf Qanauj was changed to Shāhgadh by Islām Shāh between 956 and 958, the altered appellation being retained by Akbar, whose coins bear the name of Qanauj 'urf Shāhgadh.

Sharīfābād.

This was a Bengal mint established in 946 by Sher Shāh almost at the commencement of his reign. Its existence at this early date is interesting as showing the extent of his dominions at the time when he defeated Humāyūn and further as indicating the manner in which he completed the conquest of Bengal proper after securing all the country from Rohtās to the sea.

The mint was maintained by Islām Shāh, but appears to have ceased operations after 954.

Shergadh.

Coins were struck at many places bearing this name in the reign of Sher Shāh, but generally the locality is designated clearly by some addition such as Shergadh 'urf Ḥaẓrat Dehli, Shergadh 'urf Qanauj, and so on. Shergadh plain and simple or Qila' Shergadh implies the Shergadh *par excellence*, the fortress which was regarded rightly as the foundation of the imperial structure erected by that remarkable soldier and statesman.

The story of the acquisition by Sher Shāh of the fort of Rohtās made so great an impression on the minds of the historians that they generally formed the conclusion—a conclusion adopted by no less an authority than Edward Thomas—that Rohtās was renamed Shergadh. The impression is strengthened by the statement in the 'Tārīkh-i-Sher Shāhī' that Rohtās was garrisoned by 10,000 matchlockmen and that treasures without number or reckoning were kept in the fort. This may have been the case, but Rohtās was not Shergadh and it is very doubtful whether Rohtās possessed a mint.

The fort of Shergadh is well known as a Protected Monument. It is in the Shāhābād district, about halfway between Bhabua and Rohtās, and is described, somewhat inadequately it is true, in the Annual Report of the Archaeological Survey, Eastern Circle, for 1902. There it is stated that Sher Shāh built the fort as being more advantageously situated than Rohtās. 'Abbās Khān, the author of the history quoted, states that Sher Khān, as he then was, built a fortress as a refuge in the hills of Nahrkunda or Bahrkunda, as it is written variously, and gave it the name of Shergadh. The difference between Rohtās and Shergadh was well known to Abu-l-Fazl, who states that first Rohtās and then Shergadh surrendered to Akbar in the 21st year of his reign.

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Silver coins of Sher Shāh were issued at least as early as 945 from the mint of Shergadh. In the last two years of the reign the type is different from any other rupee of this Sulṭān, as the name of Sher Shāh is preceded by the title المتوكل على الله الرحمان and the mint is given as Qila' Shergadh. Mr. Rodgers published a small copper coin with the date 943, but this reading seems somewhat doubtful, though it is certain that Sher Shāh first assumed the royal title at this place.

Islām Shāh issued both silver and copper coins from the Shergadh mint, but as the Sūrī kingdom became more strongly established, the place, only slightly less remote than Rohtās, seems to have lost its political and numismatic importance, its retention being doubtless due to sentimental considerations.

It is just possible that Islām Shāh changed the name to Shāhgadh, as we find coins of that mint up to 964, when Dehli (q.v.) had been lost; but soon after the fortress passed with Rohtās into other hands, and when conquered by Akbar both belonged to the Hindu Rāja of Gañjautī.

Shergadh 'urf Bakar.

The stronghold of Bakar or Bhakkar on the Indus was conquered by Altamsh, but in later days was generally held by some independent or quasi-dependent chieftain. 'Abbās Khān, the author of the 'Tārīkh i-Sher Shāhī' states that Haibat Khān, after suppressing the Biluch rebellion in 949, founded a city in the country of Multān which he named Shergadh. This was known as Shergadh 'urf Shiqq-i-Bakar and a mint was instituted there. Rupees of Sher Shāh from 950 onwards are known, as well as gold and silver coins of Islām Shāh, while the British Museum possesses a fine rupee of Muḥammad 'Ādil from this mint.

Shergadh 'urf Ḥazrat Dehli.

See Dehli.

Shergadh 'urf Qanauj.

The ancient city of Qanauj was undoubtedly used as a mint in the days of Muḥammad bin Sām for the production of the gold coins struck after the model adopted by the Gahar-wār Rājas of that place; but the mint name is not given, and Qanauj does not appear on any coin till the days of Islām Shāh, whose dāms of this issue are well known.

A rare rupee of Altamsh struck at Bilādu-l-hind has an imperfect legend on the reverse containing the words حراج فتح و كول. It is suggested that the "cities of Ind" may be here specified and that the provincial capitals of Qanauj and Koil ('Alīgarh) are designated.

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The name Shergadh derived its origin from a fort built by Sher Shāh near the old city and occupied by a permanent garrison. It does not appear, however, that a mint was established till the following reign, the earliest recorded coin being of 955.

See however Shāhgadh.

Shergadh 'urf ?

Two types of dāms struck by Sher Shāh bear the mint-name of Qila' Shergadh 'urf (?). The alias is written بيول, but the identification is difficult, as the word in some cases appears بيول and in others بيول. It is not likely to be the original Shergadh, for these coins do not appear before 950, by which time the Shergadh in the Shahābād district had become too well known to need any explanatory description. There were many places called Shergadh and the choice is varied. One lies due west of Jodhpur, and another was on the North-West Frontier, also known as little Rohtās. Both had permanent garrisons and either might have been a place of mintage, though the latter was unnecessary owing to the proximity of Malot. The problem awaits solution, but it is possible that the fort in Bihār took its alias from an adjoining village of Bewal.

Sulṭānpūr (I).

This name was given by Muḥammad bin Tughlaq to the town of Warangal in the Nizām's dominions. Gold coins, both the heavy *dināṛs* of his early years and light pieces of 140 grains after 733, were struck there, but the place did not remain long under the control of Dehli, and its numismatic interest disappears before the end of this reign.

Sulṭānpūr (II).

A single silver coin of Ghiāṣu-d-din Balban and a solitary copper specimen bear the name of Khiṭa Sulṭānpūr as their place of mintage. It seems certain that this town lay in the Punjab and it probably derived its name from the assumption of royalty by the former viceroy, who so long had held that province under his sway. Consequently it is safe to assume that the mint took its name from the town of Sulṭānpūr which is situated on the east bank of the Beās, in the southern extremity of the Kapurthala State. This was the recognized crossing on the route from Dehli to Lāhor, and the place is mentioned frequently by the historians from the days of Balban onwards.

Sunārgāon

This was exclusively a Bengal mint and the sole reason for its inclusion in this list is the existence of gold and silver

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coins, the latter published by Thomas, which were struck at this place in 728 by Ghiāṣu-d-dīn Bahādur Shāh of Bengal under the explicit suzerainty of Muḥammad bin Tughlaq.

Tilang, see *Mulk-i-Tilang*..

Tirhut see *Tughlaqpūr*.

Tughlaqpūr 'urf Tirhut.

This appellation appears solely on coins of Muḥammad bin Tughlaq, who seems to have commemorated his conquests in the East by giving Tirhut his own name. A solitary gold coin with this designation is known, but it appears also on the rare brass *tankas* struck in the days of the forced currency, recorded dates being 730 and 731.

The White King Catalogue contains a reference to a coin of Fatḥ Khan and Fīroz which is supposed to have been struck at Iqlīm Tughlaqpūr, but this reading must be regarded as conjectural till verified by other specimens. It is probable that the suggestion arose from the now established fact that Fatḥ Khan struck coins with the mint name Iqlīmu-sh-Sharq, the place of issue being probably Jaunpūr.

Ujjain.

The ancient city of Ujjain, celebrated in tradition as the capital of Vikramādityā, figures largely in the history of the Dehli Sulṭāns, but no mint appears to have been established there till its conquest by Sher Shāh in 949. Rupees of two types issued in that year and others are known of later date; but apparently no copper coin was struck, and the mint seems to have ceased work when Islām Shah came to the throne.

H. Nevill.

220. The Coins of Muḥammad bin Tughlaq.

"The work of filling in the interstices left by Mr. Thomas in his 'Catalogue of Pathan Coins' has of late made such steady progress, that the time would seem to have come to collect the scattered notices of new coins brought to light during the past twenty years, and to prepare a comprehensive catalogue of the period. Under present conditions the private collector, who desires to know how far his own coins add to the general knowledge, has to devote to his object an amount of research for which he is little able to spare time, through journals and proceedings to which he possibly may not have easy access."

So wrote Mr. H. Nelson Wright just nineteen years ago in the Journal of the Royal Asiatic Society, but although since

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that article[1] was written, many scattered notices of interesting coins of the Muḥammadan Sulṭāns of Dehlī have appeared in various journals, no attempt has been made by any numismatist to draw up and publish lists of the coins issued by any of the kings of the dynasties, which comprised the era of Muḥammadan rule in India. It is with a view to assisting others interested in this branch of Indian numismatics that I publish this list of the coins of Sulṭān Muḥammad bin Tughlaq—a list which was originally drawn up for my own information, but one which I have reason to believe will be of service to others.

So far as possible, in denoting coins, I have recorded specimens published in the catalogues of the various museums of India. Catalogues of all collections in Indian Museums have however not yet been published and besides museum collections there are several private collections in existence which contain interesting and often unique coins. These have as far as possible been recorded in the list, but owing to the War I have been unable to draw upon the store of interesting coins contained in the fine collection of Mr. H. Nelson Wright, than whom I know of no one more qualified and capable of evolving a complete compendium of the coins of the Muhammadan Sulṭāns of Dehli, a work which is much to be desired and one which, taking into view the work which has lately been done on other branches of Indian numismatics, is long overdue.

The list of the mintages of Muḥammad bin Tughlaq published herewith is, I am sure, by no means complete. If however the publication results in the correction of any inherent inaccuracies and in the bringing to light of coins not contained in the list, then I will feel that the publication of this catalogue has been useful.

A list of the references and abbreviations employed has been included as also a set of translations of the coin legends. For the translations I am indebted to those published by Mr. Nelson Wright in his 'Catalogue of Coins in the Indian Museum, Calcutta,' and to renderings of Thomas in his 'Chronicles of the Pathan kings of Dehli.' The publication of a complete set of plates of the coins described would have been a desirable feature but, in view of the expense involved and the difficulties in the way of obtaining casts of many unique coins, the idea must be abandoned. As far as possible the publications in which the various coins have already been figured have been noted. I have to record my indebtedness to those numismatists who have sent me information regarding coins in their private collections and especially to

[1] Addenda to the series of Coins of the Pathān Sultāns of Dehli by H. Nelson Wright, I.C.S., Journal of the Royal Asiatic Society, 1900.

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Col. H. R. Nevill, I.C.S., who has greatly assisted me by giving me the benefit of his intimate knowledge of the coinage of the period and by editing this catalogue before it went to press.

I. "Kalima" and "Companion" Type.

Obv.

The Kalima in a circle.
Margin:—
ضربت هذه السكة بحضرت
etc. دهلی فی سنة

Rev.

ابو بکر
المجاهد فی
سبیل الله
محمد بن تغلق شاه

Mint *Ḥazrat Dehlī.*

Gold.

1. Date 725 A.H. (wt. 169 grs., s. ·95), I.M.C. No. 301.

Silver.

2. Date 725 A.H. (wt. 166 grs., s. ·1″), I.M.C. No. 321 (fig.)
3. Date 728 A.H., White King Sale Cat. No. 3147.

Mint *Dāru-l-Islām.*

Gold.

4. Date 725 A.H. (wt. 168 grs., s. ·8), I.M.C. No. 302.
5. ,, 727 A.H. (wt. 167·3 grs.), Thos. No. 172.
6. ,, 729 A.H., Indian Museum.

Silver.

7. Date 725 A.H. (wt. 168·7 grs., s. ·95), I.M.C. No. 322,
8. ,, 726 A.H., (wt. 169 grs.), H. Nelson Wright. J.R.A.S., 1900 (pl. I, fig. 13).

Mint *Iqlīm Tughlaqpūr 'urf Tirhut.*

Gold.

9. Date 735 A.H. (wt 170 grs., s. ·85), R. B. Whitehead, J.A.S.B., 1910, p. 567.

Mint *Satgāon.*

Silver.

10. Date 729 A.H. (wt. 170·5 grs., s. ·95), I.M.C. No. 324 (fig.)
11. ,, 730 A.H. (wt. 170·5 grs.), I.M.C. No. 325.
12. ,, 733 A.H. (wt. 168 grs.), I.M.C. No. 327.

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Mint *Shahr Lakhnautī.*

Gold.

13. Date 734 A.H. (wt. 172 grs.), Coll. H. R Nevill.

Silver.

14. Date 727 A.H. (wt. 168·5 grs. s. 1·02). L.M.C. p. 48, No. 1.
15. Date 729 A.H., Coll. H. R. Nevill.
16. ,, 730 A.H., ,, ,, ,,
17. ,, 733 A.H., (wt 168·5 grs.), Thos., No. 187, *cf.* G. B. Bleazby, J.A.S.B., 1904, N.S. III., No. 19 (fig. pl. IX, 1), for a variety with obv. and rev. arranged in square areas.
19. B.M.C. No. 275 is another variety but the date is doubtful.

II. "Kalima" Type.

A.

Obv. — The Kalima in a circle.

Rev. — In a double circle.

ضرب فی زمن
العبد الراجی رحمة
الله محمد بن تغلق

Margin :—
etc. هذا الدینار بحضرة دهلی فی سنة

Mint *Hazrat Dehlī.*

Gold.

20. Date 727 A.H. (wt. 189·9 grs., s. ·7), I.M.C. No. 306.
21. ,, 728 A.H. (wt 198·5 grs.), Thos. No. 173.
22. ,, 729 A.H., Thos. No. 173.

As above but العدلی in margin in place of الدینار

Silver.

22A. Date 727 A.H., (wt. 142 grs.) Coll. H. Nelson Wright.

Mint *Satgāon.*

Gold.

23. Date 734 A.H. (wt. 198·3 grs., s. ·65), L.M.C. p. 47, No. 2.
24. ,, 735 A.H. (wt. 198·3 grs., s. ·65), L.M.C. p. 47, No. 1.

B.

As above but date in margin in figures.

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Mint *Qibbatu-l-Islām a'nī Ḥaẓrat Deogīr.*

Gold.

25. Date 727 A.H. (wt. 197 grs., s. ·7), I.M.C. No. 307.
26. ,, 728 A.H. (wt. 193 grs.), I.M.C. No. 308 (fig.).
As above but عدلي

Silver.

26A. Date 727 A.H. (wt. 141·5 grs), Coll. H. Nelson Wright.
As above, but سكه instead of دينار

Mint *Qibbatu-l-Islām a'nī Dāru-l-mulk Daulatābād.*

Gold.

27. Date 728 A.H. (wt. 141 grs.) H. Nelson Wright J.R.A.S. 1900 II, No. 11, pl. I, 10.

Mint. *Qibbatu-l-Islām a'nī Ḥaẓrat Daulatābād.*

Gold.

28. Date 730 A.H. (wt. 143 grs., s. ·7), H. Nelson Wright, J.A.S.B. 1905, N.S.V. (fig. pl. IV, 1).

Mint *Dāru-l-mulk Sulṭānpūr.*

Gold.

29. Date 729 A.H. (wt. 142 grs.), H. Nelson Wright, J.R.A.S. 1900, II, No. 10 (fig. pl. I. 9).
29A. ,, 730 A.H. (wt. 142 grs.), Coll. H. Nelson Wright.
30. ,, 732 A.H. (wt. 141·5 grs.), Coll. H. R. Nevill.

C.

Obv.
The Kalima.
Margin :—
ضرب هذا الدينار فى قلعه ديوگير
etc. سنة

Rev.
فى زمن العبد
الواثق بنصر الله
محمد بن تغلقشاه

Gold.

31. Date 729 A.H. (wt. 170 grs.), Coll. Lucknow Mus.

III. The "Āzān" Type.

Obv.
اشهد ان لا
اله الا اللّٰه
و اشهد ان مُحَمَّدً
عبده و رسوله

Rev.
In a circle.
الواثق بتاييد
الرحمن محمد
شاه السلطان
Margin :—
ضرب هذا الدينار بحضرت دهلى سنه etc.

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Mint *Ḥaẓrat Dehlī.*

Gold.

32. Date 725 A.H. (wt. 195·5 grs.), Thos. No. 171.
33. ,, 726 A.H. (wt. 199·5 grs., s. ·9), I.M.C. No. 303.
34. ,, 727 A.H. (wt. 195 grs.), I.M.C. No. 304.
As above but "'adalī" instead of "dīnār" in margin.

Mint *Ḥaẓrat Dehlī.*

Silver.

35. Date 725 A.H. (wt. 140 grs.), Thos. No. 180.
36. ,, 726 A.H. (wt. 141·5 grs., s. ·95), I.M.C. No. 323 (fig.)
37. ,, 727 A.H. (wt. 138 grs.), Thos. No. 181.
As above but "dīnār" in margin.

Mint *Shahr Sulṭānpūr.*

Gold.

38. Date 726 A.H. (wt. 169·5 grs.), Coll. H. Nelson Wright.
38A. ,, 728 A.H. (wt. 198 grs., s. ·8), Coll. H. R. Nevill.
39. ,, 729 A.H. (wt. 170 grs.), Thos No. 175 and 175*a*.

Mint. *Qibbatu-l-Islām a'ni Ḥaẓrat Deogir* ('adalī).

Silver.

39A. Date 727 A.H. (figures) (wt. 142·5 grs.) Coll. H. Nelson Wright.

IV.

Obv.

و الله
الغني و انتم
الفقراء

Rev.

In a circle.
فی عهد
محمد بن
تغلق

Margin :—
etc. بحضرة دهلی سنة

Mint *Haẓrat Dehlī.*

Gold.

40. Date 727 A.H., Thos. No. 176.
41. ,, 733 A.H., ,, ,, ,,
42. ,, 736 A.H., (wt. 170·7 grs., s. ·7), I.M.C. No. 312.
43. ,, 737 A.H., (wt. 171 grs.), I.M.C. No. 313.
44. ,, 741 A.H., White King Coll. Sale Cat. No. 3136.

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Silver.

45. Date 732 A.H. (wt. 170·3 grs., s. ·85), I.M.C. No. 326 (fig.)

Mint *Dāru-l-Islām.*

Gold.

46. Date 734 A.H., H. Nelson Wright, J.R.A.S. 1900, p. 776.
47. ,, 737 A.H. (wt. 170·5 grs.), H. Nelson Wright, J.R.A.S. 1900, II, No. 12, pl. I, 11.

Silver.

48. Date 734 A.H. (wt. 168 grs.), Thos No 188.

V. Half-Dinar.

Obv.

محمد
بن تغلق
شاه

Rev.

محى
سنن خاتم
النبيين

Gold.

49. Wt. 99·4 grs., s. ·65, I.M.C. No. 314 (fig.)

VI.

Obv.

In a six-foil border within a circle.

ضرب
فى زمن العبد
الراجى رحمة
الله محمد
بن

Rev.

In a circle.

السلطان
السعيد الشهيد
تغلق شاه سنة

, and date in Arabic.

Gold.

50. Date 728 A.H. (wt. 198 grs.), Coll. H. Nelson Wright.
50A. ,, 729 A.H. (wt. 197·5, s. ·8), I.M.C. No. 309 (fig.)

As above but legend on obverse enclosed in a pentagon composed of three interwoven lines.

51. Date 729 A.H. (wt. 169 grs.), Coll. H. R. Nevill.
52. ,, 733 ,, (wt. 169·8 grs., s. ·7), I.M.C. No. 310.
53. ,, 734 ,, I.M.C. No. 311.
54. ,, 739 ,, (wt. 169 grs), Thos. No. 179.
55. ,, 741 ,, Coll. H. R. Nevill.

Billon.

56. ,, 727 ,, Coll. H. R. Nevill.
57. ,, 728 ,, (wt. 134·7 grs., s. ·75), I.M.C. No. 330.

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58. Date 729 A.H. (wt. 140 grs.), I.M.C. No. 331.
59. ,, 730 ,, (wt. 140 grs.) I.M.C. No. 332.
60. ,, 730 ,, with date wholly in last line. Coll. H. R. Nevill.
61. ,, 731 ,, (wt. 142 grs.), I.M.C. No. 333 (fig.).
62. ,, 732 ,, (wt. 144 grs., s. ·8), Coll. H. M. Whittell.
63. ,, 734 ,, (wt. 136·5 grs.), I.M.C. No 334.
64. ,, 735 ,, Coll. H. R. Nevill.
65. ,, 737 ,, ,, ,, ,,
66 ,, 740 ,, ,, ,, ,,
67. ,, 741 ,, (wt. 139 grs., s. ·7), Coll. H. M. Whittell.
68. ,, 742 ,, Coll. H. R. Nevill.
69. ,, 747 ,, (wt. 140 grs., s. ·75), L.M.C. p. 48, No. 2.

VII.

Obv.

In circle.
المجاهد فى
سبيل الله

Rev.

In circle.
محمد بن
تغلقشاه
٧٢٥

Billon.

70. Date 725 A.H. (wt. 57 grs., s. ·55), I.M.C. No. 335 (fig.).
71. ,, 726 A.H., Coll. H. R. Nevill.
72. ,, 727 A.H. (wt. 57 grs., s. ·6), L.M.C. Supp. p. 19, No. 142.
73. ,, 728 A.H., Coll. H. R. Nevill.

As above but السّلطان in place of date on reverse.

Billon.

74. (wt. 52 grs., s. ·7), R. B. Whitehead, J.A.S.B. 1910 No. V.

VIII.

Obv.

سلطان الا
عظم ذى الفتح
والباذل

Rev.

بن
محمد
تغلقشاه

Billon.

75. Date 727 A.H. (wt. 30 grs.), Coll. F. J. Thanawala. Apparently a coin issued in Ma'abar. My rendering of the legend on obv. is open to correction. I believe Mr. R. B. Whitehead intends publishing the coin.

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IX.

Obv.	*Rev.*
In a circle.	In a circle.
السلطان	محمد بن
العادل	تغلق شاه

Billon.

76. Date 726 A.H. (wt. 57 grs., s. ·55), I.M.C. No. 337.
77. ,, 727 A.H. (wt. 56 grs.), I.M C. No. 339 (fig.).
78. ,, 728 A.H. (wt. 50 grs.), I.M.C. No. 341.
79. ,, 729 A.H., Rodgers' Cat. p. 94, No. 35.

X.

Obv.	*Rev.*
فی زمن السلطان	دامت سلطنته
العادل محمد بن	فی سنة سبع و عشرین
تغلقشاه	و سبعمایة

Billon.

80. Date 727 A.H. (wt. 55·2 grs., s. ·55), I.M.C. No. 342 (fig.).
81. ,, 732 A.H., Thos. No. 192.

XI.

Obv.	*Rev.*
In a circle.	In a circle.
الواثق	محمد بن
بنصر الله	تغلق شاه
۷۳۰	

Billon.

82. Date 730 A.H. (wt. 53 grs., s. ·55), I.M.C. No. 343 (fig.)
83. ,, 733 A.H. (wt. 54 grs.), Coll. R. B. Whitehead.
84. ,, 734 A.H., White King Coll. Sale Cat. No. 3164.

XII.

Obv.	*Rev.*
In a circle.	In a circle.
الملک	عبد الواجی
و العظمة	محمد تغلق
لله	۷۳۲

Billon.

85. Date 732 A.H. (wt. 55 grs., s. ·55), I.M.C. No. 344.
86. ,, 733 A.H. (wt. 56·5 grs.), I.M.C. No. 345.

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87. Date 734 A.H., I.M.C. No. 346 (fig.)
88. ,, 735 A.H. (wt. 57 grs.), I.M.C. No. 347.
89. ,, 736 A.H., I.M.C. No. 348.
90. ,, 737 A.H. (wt. 55 grs., s. ·6), Coll. H. M. Whittell.
91. ,, 738 A.H., I.M.C. No. 349.
92. ,, 739 A.H., Thos. No. 193.

XIII.

Obv.

الراجى
رحمة الله
الكريم

Rev.

محمد بن
تغلق سنة

and date in Arabic words.

Billon.

93. Date 727 A.H., Thos. No. 194.
94. ,, 730 A.H., Thos. No. 194.
95. ,, 732 A.H., Coll. H. R. Nevill.
96. ,, 733 A.H. (wt. 55 grs., s. ·6), I.M.C. No. 350.
97. ,, 734 A.H. (wt. 55 grs.), I.M.C. No. 351 (fig.)
98. ,, 735 A.H. (wt. 54 grs.), I.M.C. No. 352.
99. ,, 736 A.H. (wt. 53 grs., s. ·55), L.M.C. Supp. p. 9, No. 143.
100. ,, 737 A.H. (wt. 56 grs.), I.M.C. No. 353.
101. ,, 738 A.H., Thos. No. 194.
102. ,, 739 A.H., Rodgers' Cat. p. 94, No. 32 [Date doubtful].

XIV.

Obv.

As above in double circle.

Rev.

In circle.

محمد بن
تغلق سنة
٧٣٤

Billon.

103. Date 734 A.H. (wt. 50 grs., s. ·6), R. B. Whitehead, J.A.S.B. 1910, No. IV.

XV.

Obv.

الراجى
رحمة الله
الكريم

Rev.

In double circle.

محمد
تغلق

Margin :—

سنة اربع و ثلثين و سبعماية

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Billon.

104. (Wt. 52·5 grs., s. ·45), I.M.C. No. 354 (fig.).
105. Date 734 A.H., Coll. H. R. Nevill.

XVI.

Obv.	*Rev.*
In a double circle.	In a double circle.
السلطان	محمد بن
ظل الله	تغلقشاه

Copper.

106. (Wt. 65 grs., s. ·6), I.M.C. No. 364 (fig.).

XVII.

Obv.	*Rev.*
In a double circle.	In a double circle.
حسبی	محمد بن
ربّی	تغلق

Copper.

107. (Wt. 56 grs., s. ·6), I.M.C. No. 365.
As above but حسبے in place of حسبي

Copper.

108. (Wt. 53 grs., s. ·54), Coll. H. M. Whittell.

XVIII.

Obv.	*Rev.*
In a circle.	In a circle.
حسبے	عبد
ربّی ۷۳۰	محمد بن تغلق

Copper.

109. Date 730 A.H. (wt. 50·5 grs., s. ·5), I.M.C. No. 366 (fig.).
110. ,, 732 A.H. (wt. 54 grs., s. ·54), L.M.C. Supp. p. 20, No. 144.

XIX.

Obv.	*Rev.*
	In a double circle.
الملک	محمد
و العزة لله	تغلق

Margin :—
سال بر هفتصد سی دو

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Copper.

111. Date 732 A.H. (wt. 53 grs., s. ·55), I.M.C. No. 368 (fig.).

112. 741 A.H., Coll. H. R. Nevill.

XX.

Obv.	*Rev.*
In a double circle.	In a double circle.
محمد	تغلقشاه

Copper.

113. (Wt. 55·5 grs., s. ·5), I.M.C. No. 370.

XXI.

Obv.	*Rev.*
الإمام	محمد بن
العادل	تغلق شاه

Copper.

114. (Wt. 55 grs.), Rodgers J.A.S.B. 1895. Apparently a coin issued in Ma'bar.

XXII.

Obv.	*Rev.*
تغلق	دارالملک
شا (sic)	دهلي
محمد بن	

Copper.

115. (s. ·6), B.M.C. No. 324.

STRUCK IN THE NAME OF THE KHALĪFA AL MUSTAKFĪ.

XXIII.

Obv.	*Rev*
ضرب هذا الدينار	فى زمان الامام
الخليفيے فى الدهلى فى شهور	المستكفى بالله اميرالمومنين ابوالربيع
سنة احدى و اربعين و ستماية	سليمان خلد الله خلافته
m.m. 7 (I.M.C.) in last line.	m.m. 4 in first line.

Mint Dehlī.

Gold.

116. Date 741 A.H., B.M.C. 228 (fig.)

117. ,, 742 A.H. (wt. 168 grs., s. ·8), I.M.C. 315, but no mint marks on either face.

118. 742 A.H. (wt. 169 grs., s. ·1), Coll. H. M. Whittell.

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Obverse and reverse arranged in a quatrefoil within a double lined circle and m.m. on rev.

119. Date 743 A.H. (wt. 168 grs.), I.M.C. No. 316, but no m. marks.

120. Date 744 A.H., (wt. 169 grs.), I.M.C. No. 317, no m.m. on obv.

Mint. *Daulatābād.*

omitting فی before شهور on obverse.

121. Date 745 A.H. (wt. 170 grs.), Coll. H. Nelson Wright.

With Reverse as above and with obverse of No. 40 above, apparently a "freak."

Gold.

122. Wt. 172·3 grs., Rodgers, J.A.S.B. 1894, No. 22, p. 68 (fig. pl. V, 22).

With Reverse as above on both faces. Apparently a "freak."

Gold.

123. Bodleian Library Cat. No. 509.

As on No. 121 but m.m. 7 on obv. and m.m. 2 on reverse.

Silver.

124. Date 742 A.H. (wt. 161·7 grs.), H. Nelson Wright, J.R.A.S. 1900, II, No. 14 (fig. pl. I, 13).

[NOTE.—This cannot be regarded as a silver type, being struck from a gold die.]

XXIV.

Obv.

الامام الاعظم
خليفة الله فی
للعالمين

Rev.

In a circle,
المستكفي
با لله امير المو
منين

Margin :—
ضربت هذه السكه بحضرت دهلی
..... اربعين و سبعماية

Mint *Hazrat Dehli.*

Billon.

125. Date 74– A.H. (wt. 143, s. ·75), I.M.C. No. 357 fig.

126. ,, 744 A.H., Coll. H. R. Nevill.

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Mint *Daulatabād.*

Billon.

127. 744 A.H. (wt. 138 grs.), Thos, No. 215*a*. This coin has also date in figures below on Obv.
As above but margin on reverse reads

سال بر هفتصد خمسین و ست

Billon.

128. Date 756 A.H. (wt. 125·5 grs.), H. Nelson Wright, J.R.A.S. 1900, No. 17 (pl. I, 14).

XXV.

Obv.	*Rev.*
	In circle.
الامام الاعظم	المستكفى
خليفه الله في	بالله امير
العالمين	المومنين
٧٤٥	Margin :—
	ضرب هذ ..... سبعماية

Billon.

129. Date 745 A.H. (wt. 146 grs., s. ·7), I.M.C. No. 359, fig.

XXVI.

Obv.	*Rev.*
خليفه	المستكفى
الله فى	بالله
شهور	٧٤٢

Billon.

130. Date 742 A.H. (wt. 55 grs.), Thos. No 216.
131. ,, 743 A.H., B.M.C. No. 333 (fig.).

N.B.—Thomas classed this coin as of copper. It is however of billon and one in my own collection dated 743 A.H. is of nearly pure silver.

XXVII.

Obv.	*Rev.*
الله	و الخليفه
الكافي	المستكفي

Copper.

132. (wt. 52 grs., s. ·5), I.M.C. No. 372.
As above but m.m. 7 below on obverse and above and below on reverse.

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Copper.

133. (Wt. 77 grs.), Rodgers, J.A.S.B. 1894 (fig. 36).

XXVIII.

Obv.	*Rev.*
الله	و الخليفه
الكافى	المسكفى
فى شهور	٧٤٢

Copper.

134. Date 742 A.H., (wt. 55 grs.), Thos. No. 217.
135. ,, 744 A.H., Coll. H. R. Nevill.

STRUCK IN THE NAME OF THE KHALĪFA AL ḤĀKIM II.

XXIX.

Obv.	*Rev.*
In a cinque foil.	In a cinque foil.
فى زمان الامام	الله ابو
المومنين	العباس احمد
امير——ر	خلد ملكه
الحاكم بامر	

Gold.

136. (Wt. 170 grs., s. 75), I.M.C. No. 318.
As above but no marginal ornamentation and m.m. 2 on reverse.

Gold.

137. (Wt. 168 grs.), I.M.C. No. 319.

XXX.

Obv.	*Rev.*
	الله س
As above but no marginal ornamentation.	ابو العبا
	احمد خلد ملكه

Gold.

138. (Wt. 169), I.M.C. No. 320 (fig.).

XXXI.

Obv.	*Rev.*
In a quatrefoil within a circle.	In a quatrefoil within a circle.
الله	احمد
الحاكم	ا العباس
بامر	بو

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Gold.

139. Coll. Prince of Wales Mus. Bombay.

Billon.

140. (Wt. 140 grs.), Coll. H. R. Nevill.
As above but with ع after بو on reverse.

Billon.

141. (Wt. 141 grs., s. ·65), I.M.C. No. 360 (fig.).
As above but with ٦ after بو on reverse.

Billon.

142. (Wt. 141 grs., s. ·65), I.M.C. No. 360.
As above but marginal ornamentation a six-foil, no m.m. after بو on reverse but m m. 2 on obverse.

Billon.

143. (Wt. 137 grs., s. ·7), Coll. H. M. Whittell.
As above but in a quatrefoil and ع after بو on reverse.

Billon.

144. (Wt, 55 grs., s. ·55), I.M.C. No. 363.
As above but ٨ after بو on reverse.

Billon.

145. (Wt. 52 grs., s. ·52), Coll. H. M. Whittell.

XXXII.

Obv.	*Rev.*
In cinquefoil.	In cinquefoil.
الامام	الله
امير المومنين	بامر احمد
الحاكم	ابو العباس
	خلد خلافته

Billon.

146. ((Wt. 140 grs., s. ·75), Coll. T. B. Horwood.

XXXIII.

Obv.	*Rev.*
	In a circle.
الله	(m.m. 3.) ابو
الحاكم	العباس
بامر	(m.m. 4) احمد

٧٤٨

Billon.

147. Date 748 A.H. (wt. 135 grs., s. 6·5), Coll. H. M. Whittell.
148. ,, 749 A.H. (wt. 125 grs., s. ·7), I.M.C. No. 473 (fig.).
149. ,, 750 A H., Thos. No. 218.
150. ,, 751 A.H., Thos. No. 218.

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XXXIV.

Obv.	*Rev.*
In a circle.	In a circle.
الحاكم	ابو
بامر الله	العباس
٧٤٨	احمد

Copper.

151. Date 748 A.H., B.M.C. No. 340.
152. ,, 749 A.H., (wt. 55 grs., s. ·50), I.M.C. No. 374.
153. ,, 750 A.H., Rodgers' Cat. No. 44, p. 96.
154. ,, 751 A.H., Dehli Mus. Cat.
155. ,, 752 A.H., Coll. H. R. Nevill.
156. ,, 759 A.H., Coll. H. R. Nevill [a coin of Fīroz Shāh].
156A. ,, 771 ,, ,,

STRUCK IN MEMORY OF HIS FATHER SULṬĀN GHIYĀṢU-D-DĪN TUGHLAQ.

XXXV.

Obv.	*Rev.*
	In a circle.
السلطان	ابو المظفر
السعيد الشهيد	تغلق شاه السلطان
الغازى غياث الدنيا	انار الله برهانه
و الدين	Margin :—
	ضرب هذه السكه فى بلده دولت اباد سنه etc.

Mint *Daulatabād.*

Gold.

157. Date 725 A.H. (wt. 165·5 grs.), H. Nelson Wright, J.R.A.S. 1900, II, pl. I, 6.
158. ,, 726 A.H. (wt. 173 grs., s. 1), I.M.C. No. 300 (fig.).
159. ,, 727 A.H. (wt. 169·2 grs.), H. Nelson Wright, J.R.A.S. 1900, II, pl. I, 7.

Silver.

160. Date 726 A.H. Coll. Mr. Panna Lall, I.C.S.
As above but only ضرب هذاالسكه ... سنة ... ثلثين و سبعماية of marginal inscription legible.

Gold.

161. Date 73 × (wt. 245 grs.). Thos. No. 178 (a worn coin).

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Mint *Mulk-i-Tilang.*

Gold.

161A. Date 726 Rodgers J.A.S.B. 1880 p. 211.

Silver.

161B. Date 725 (wt. 171 grs.), Coll. H. R. Nevill.

XXXVI.

Obv.

السلطان
السعيد الشهيد
الغازى غياث الدنيا
و الدين

Rev.

ابو المظفر
تغلق شاه السلطان
انار الله برهانه
٧٢٨

Billon.

162. Date 728 A.H. (wt. 54·5 grs., s. ·5), I.M.C. No. 329.
163. ,, 731 A.H. Rodgers, J.A.S.B. 1883, No. 29. pl. V. (This date is doubtful).
164. ,, 734 A.H. (wt. 51 grs.), Thos., p. 213.

XXXVII.

Obv.

In a square with traces of an outer circle.

السلطان الغازى
غياث الدنيا و الدين
ابو المظفر

Rev.

In a circle.
تغلق شاه
السلطان ناصر
امير المومنين
٧٢١ھ

Margin :—
هذا السكه بحضرة دهلى فى سنة سبع
و عشرين و سبعماية

Gold.

165. Date 727 A.H. (wt. 173, s. ·9), H. Nelson Wright, J.A.S.B. 1904, No. 11 (pl. III, 1).

XXXIX.—Forced Currency.

"*Tankahs.*"

Obv.

In a circle.
من اطاع
السلطان
فقد اطاع
الرحمان

Rev.

مهر شد تنكه
رائج در روزگار
بنده اميدوار
محمد تغلق

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Margin :

در تخت‌گاه دهلی سال بر

هفصد (sic)- سی

NOTE.—In some cases the year is written سے.

Mint *Takhtgāh Dehlī.*

Brass.

166. Date 730 A.H. (wt. 137 grs., s. 75), I.M.C. No. 375.
167. ,, 731 A.H. (wt. 138 grs.), I.M.C. No. 376.
168. ,, 732 A.H. I.M.C. No 377.

Mint *Dāru-l-Islām.*

Brass.

169. Date 730 A.H. (wt. 142 grs., s. ·8), I.M.C. No. 378.
170. ,, 731 A.H. Dehli Mus. Cat.
171. ,, 732 A.H. Coll. H. R. Nevill.

Mint *Dara Dhār.*

Brass.

172. Date 731 A.H. (wt. 147 grs., s. ·75), I.M.C. No. 379.

Mint *Dara Dāhār.*

Brass.

173. Date 731 A.H. (wt. 138 grs., s. ·7), Rodgers' Cat. No. 5, p. 90.

Mint *Iqlīm Lakhnautī.*

Brass.

174. Date 731 A.H. (wt. 142 grs., s. ·75), I.M.C. No. 382.
175. ,, 732 A.H. Rodgers' J.A.S.B. 1883, No. 31, pl. V.

Mint *'Arsa Satgāon.*

Brass.

176. Date 730 A.H. (wt. 143 grs., s. ·8), I.M.C. No. 383.
177. ,, 731 A.H. (wt. 141·5 grs., s. ·78), Rodgers' Cat. No. 8, p. 90.

Mint *Iqlīm Tughlaqpūr*, urf *Tirhut.*

Brass.

178. Date 730 A.H. White King Coll. Sale Cat. No. 3173.
179. ,, 731 A.H. (wt. 140 grs., s. ·8), I.M.C. No. 384 (fig.)
180. ,, 732 A.H. Coll. R. B. Whitehead.

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Mint *Takhtgāh Daulatābād.*

Brass.

181. Date 730 A.H. (wt. 136 grs.), Thos. No. 195, pl. IV, 97.
182. ,, 731 A.H. Coll. H. R. Nevill.

Taṇka of *fifty kānis.*

As above but نجاه كانى instead of رائج on reverse.

Mint *Takhtgāh Daulatābād.*

Brass.

183. Date 731 A.H. (wt. 141 grs., s. ·75), I.M.C. No. 385 (fig.).
184. ,, 732 A.H. Coll. H, R. Nevill.

XL. Niṣfe.

Obv.	*Rev.*
ضرب هذا	محمد بن تغلق
النصفى فى زمن	بحضرة دولت
العبد الراجى	اباد سنة ثلثين
رحمة الله	و سبعماية

Mint *Daulatābād.*

Brass.

185. Date 730 A.H. (wt. 109·5 grs., s. ·7), I.M.C. No. 389 (fig.).
186. ,, 732 A.H. White King Coll. Sale Cat. No. 3187.

XLI. Dirhams.

Obv.	*Rev.*
ضرب فى زمن العبد	الدرهم
الراجى رحمة	بدار الملك دهلى
الله محمد بن	سنة ثلثين و سبعمايه
تغلقشاه	

Mint *Dāru-l-mulk Dehlī.*

Copper.

187. Date 730 A.H. (wt. 60·5 grs., s. ·65), Rodgers' Cat. p. 92, No. 20.

XLII.

Obv.	*Rev.*
ضرب الدرهم	بحضرة
الشرعى فى زمن	دهلى فے
العبد محمد بن	سنه ثلثين
تغلق	و سبعماية

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Mint *Ḥazrat Dehlī.*

Copper.

188. Date 730 A.H. (wt. 82 grs., s. ·55), I.M.C. No. 390.
189. ,, 730 A.H. (wt. 80·5 grs.), I.M.C. No. 391 (date in one line).
190. ,, 732 A.H. I.M.C. No. 392.

Mint *Dāru-l-Mulk Dehlī.*

Copper.

191. Date 730 A.H. (wt. 81 grs., s. ·65) I.M.C. No. 394.

Mint *Dāru-l-Islām.*

Copper.

192. Date 730 A.H. (wt. 83·5 grs., s. ·6), I.M.C. No. 395 (fig.).

Mint *Ḥazrat Daulatābād.*

Copper.

193. Date 730 A.H. (wt. 79 grs., s. ·6) I.M.C. No. 396 (fig.)

XLIII—A "Fourth" (Quarter Tankah).

Obv.

In a double circle.

محمد بن
تغلق

Rev.

In a double circle.

الونعي
ضرب
۷۳۰

Copper.

194. Date 730 A.H. (wt. 67 grs., s. ·6) I.M.C. No. 397.
195. ,, 730 A.H. (wt. 70) I.M.C. No. 398 (obv. differently arranged).
196. ,, 732 A.H. (wt. 68 grs.) I.M.C. No. 399.

XLIV.—Hashtkānīs.

Obv.

In a double circle.

محمد
تغلق

Rev.

In a double circle.

عدل
هشت کانی

Copper.

197. (Wt. 56 grs., s. ·5) I.M.C. No. 401.

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XLV. Do-kānīs.

Obv.

In a circle.

محمد

تغلق

Rev.

In a circle.

سکه

دو کانی

Copper.

198. (Wt. 35 grs., s. ·45) I.M.C. No. 403 (fig.).

XLVI.

Obv.

In a square within a circle ornaments in segments

فی العهد

السلطان

Rev.

In a circle.

دو کانی

Ornament below.

Copper.

199. (wt. 50 grs.) Rodgers, J.A.S.B. 1886 No. 30, pl. IX.
[Reading of obverse is doubtful.]

XLVII.—Jaitil.

Obv.

In an octagon within a circle on which are 8 loops.

جیتل

Rev.

In an octagon.

دو کانے

امانی

Copper.

200. (Wt. 51·7 grs.) Rodgers, J.A.S.B. 1886, No. 26, pl. IX.

XLVIII.

Obv.

In a circle surrounded by an outer circle of dots.

جیتل

Rev.

In a circle surrounded by an outer circle of dots.

امانی

یکانے

Copper.

201. (Wt. 74 grs.) Thos No. 207.

XLIX.

Obv.

من اطاع

السلطان

محمد ۷۳۰

Rev.

فقد اطاع

الرحمان

تغلق

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Digitized by Arya Samaj Foundation Chennai and eGangotri

Copper.

202. Dates 730 A.H. (wt. 113·5 grs. s. ·65), I.M.C. No. 386 (fig.).

203. ,, 731 A.H. Rodgers, Cat. p. 93, No. 24. (Date doubtful).

L.

Obv.

اطیوا الله
و اطیو الرسول
و اولی الامر
منکم محمد ۷۳۰

Rev.

لا بولا السلطان
کل الناس
بعضهم بعضا
تغلق

Copper.

204. Date 730 A.H. (wt. 112 grs. s. ·7), I.M.C. No. 388.

205. ,, 730 A.H. (wt. 110 grs. s. ·72) Coll. H. M. Whittell (with ولے for واولی).

206. ,, 730 A.H. (s. ·65), B.M.C. No. 311 (legends differently arranged).

LI.

Obv.

In double circle.

محمد
تغلق

around.

मी: मोहमद....

Rev.

سکه زد
جائز در عهد
بنده امیدوار
محمد تغلق

Copper.

207. (Wt. 66 grs. s. ·6) I.M.C. No. 400.

COINS STRUCK BY GHIĀṢU-D-DĪN BAHADUR SHĀH OF BENGAL IN THE NAME OF MUḤAMMAD BIN TUGHLAQ.

LII.

Obv.

In square within circle.

ضرب بامر الواثق
با لله محمد بن
تغلقشاه

Margin :—

هذا السکه بحضرة سنارگانو
سنه ثمان و عشرین و سبعمایة

Rev.

In double square.

السلطان المعظم
غیاث الدنیا و الدین
الو المظفر بهادر شاه
السلطان ابن السلطان

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Digitized by Arya Samaj Foundation Chennai and eGangotri

Gold.

208. Date 728 A.H. (wt. 165 grs., s. ·9), J.A.S.B. N.S. XVI, p. 699.

Silver.

209. Date 728 A.H. (wt. 140 grs.), Thomas No. 186.
210. ,, 728 A.H. (wt. 165·5 grs.), Coll. H. R. Nevill. [v. also J.A.S.B., N.S. XVI, p. 700].

Coin Legends.

1. The Kalima or Muhammadan profession of faith.

لا اله الا الله محمد رسول الله

There is no deity but God and Muḥammad is the apostle of God.

المجاهد فى سبيل الله

The warrior in the path of God.

20. ضرب في زمن العبد الراجي رحمة الله

Struck in the time of the servant, hoping for the mercy of God.

31. فى زمن العبد الواثق بنصر الله

In the time of the servant, the one who trusts in the help of God.

32. The Āzān, the Muhammadan call to prayer

الشهد ان لا اله الا الله و اشهد ان محمدا عبده و رسوله

"I testify that there is no deity but God and I testify that Muhammad is his servant and apostle.

الواثق بتاييد الرحمن

The one who trusts in the support of the merciful.

40. و الله الغنى و انتم الفقراء

God is the rich and you the poor (Qurān XLVII, 40).

فى عهد

In the time of

49. محى سنن خاتم النبيين

Reviver of the laws of the last of the prophets

50. السعيد الشهيد

The fortunate the testifier

75. سلطان الاعظم ذى الفتح و الباذل

The supreme Sultan, the lord of victory, the munificent.

76. العادل

The just.

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80. دامت سلطنته

May his Sovereignty long continue.

85. الملک و العظمة لله

Dominion and greatness are of God.

93. الکریم

The bountiful.

106. ظل الله

The shadow of God.

107. حسبی ربّی

Sufficient is the Lord.

114. الامام

The religious chief.

116. فی زمان الامام المستکفی بالله امیر المومنین ابو الربیع سلیمان خلد الله خلافته

In the time of the religious chief al Mustakfi Billah the commander of the faithful Abu al rabī'a Sulaimān, may God perpetuate his Khalīfate.

125. الامام الاعظم خلیفة الله فی العالمین

The religious chief the supreme Khalīfa of God of the two worlds (heaven and earth).

132. الله الکافی

God the sufficient.

136. خلد ملکه

May his kingdom be perpetuated.

157. الغازي

The champion.

انار الله برهانه

May God illumine his testimony.

165. ناصر امیر المومنین

Supporter of the commander of the faithful.

166. من اطاع السلطان فقد اطاع الرحمان

He who obeys the sovereign, truly he obeys the merciful one (God).

مهر شد تنکه رائج در روزگار بنده امیدوار

This tanka is sealed as current in the reign of

184. ضرب هذا النصفی

This half-piece was struck.

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188. ضرب الدرهم الشرعي

Minted as a legal dirham.

194. ضرب الربعى

Struck as a fourth (quarter *tankah*).

197. عدل هست كانى

Legal eighth [of a *tankah*].

200. دوكانى امانى

The equivalent of one thirty-second [of a *tankah*].

203. اطيعوا الله و اطيعوا الرسول واولى الامر منكم

Obey God and obey the prophet and those in authority among you (Quran IV, 62).

لا يو الا السلطان كل الناس بعضهم بعضا

Sovereignty is not conferred upon every man some (are set over) others (Quran IV 62)

207. سكه زد جائز

Coined money lawful.

Reference.

I.M.C. = Catalogue of the Coins in the Indian Museum, Calcutta, Vol. II, by H. Nelson Wright, Oxford, 1907.

White King Sale Cat. = Collection White King. Troisième partie. Vente à Amsterdam le 26 Juin 1905....sous le direction....de l'Expert J. Schulman.

Thos. = The Chronicles of the Pathān Kings of Dehli by Edward Thomas, London, 1871.

J.R.A.S. = Journal of the Royal Asiatic Society.

J.A.S.B. = Journal of the Asiatic Society of Bengal.

L.M.C. = Catalogue of the Coins in the Government Museum, Lahore, compiled by C. J. Rodgers, Calcutta, 1891.

Rodgers Cat. = Catalogue of the coins collected by Chas. J. Rodgers and purchased by the Government of the Punjab, Part II, Miscellaneous Muhammadan Coins, Calcutta, 1894.

B.M.C. = Catologue of Indian Coins in the British Museum. The Sultans of Dehli, by Stanley Lane-Poole, London, 1884.

Bodleian Library Cat. = Catalogue of the Mohammadan Coins preserved in the Bodleian Library at Oxford by Stanley Lane-Poole. Oxford, 1888.

Dehli Mus. Cat. = Catalogue of Muhammadan Coins in the Dehli Museum of Archaeology by R. B. Whitehead.

Bleazby Sale Cat. = Catalogue des collections remarquables de M. Geo. B. Bleazby....vente à Amsterdam aux bureaux de l'Expert J. Schulman, Janvier 1913.

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A.H. = Hijra era.
M.M. = Ornament [mint-mark].
N.S. = Numismatic Supplement to J.A.S.B.
Pl. = Plate.
Fig. = Figure.
Obv. = Obverse.
Rev. = Reverse.
Coll. = Collection.
Wt. = Weight.
S. = Size in inches.
Grs. = Grains (Troy).

H. M. WHITTELL,
Major, I.A.

NOTE.—Major Whittell left India after the above paper was set up in type. It has therefore not had the advantage of revision by him. Mr. Nelson Wright and Colonel Nevill have kindly gone through the list and made a few necessary corrections and additions.

Editor.

221. COINS OF THE PATHAN KINGS OF DEHLI.

Ghiāṣu-d-dīn Tughlaq I.

In continuation of the good work begun by Major Whittell, I have endeavoured to catalogue the known coins of the father of Muḥammad bin Tughlaq, and in a further paper to describe all those issued by the successors of that remarkable monarch, so far as records are available. This is intended as a contribution to the material required for the ultimate compilation of a corpus of the coins of the so-called Pathan kings of Dehli. It is not professed that the lists are complete or exhaustive; but one of the objects in view is to draw the attention of collectors to possible omissions, in the hope that they will supply defects and thus facilitate the attainment of the eventual aim. Moreover, well explored as has been the field of Pathān numismatics, it is certain that much remains to be discovered. There are many gaps yet to be filled, and there is still room for research. The strange fact is obvious to every collector that prized acquisitions more often consist in representatives of new and unexpected types than specimens of well-known rarities.

In the case of Ghiāṣu-d-dīn Tughlaq the coins present few peculiar features. There are no billons of high value, certainly none of a higher denomination than one-eighth of a *tanka*, no small silver pieces are known and minute billons are conspicuous by their absence. The paucity of small change, in fact, contrasts remarkably with the abundant issues of his son, and still more with the comprehensive coinage of Fīroz Shāh.

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Gold.

1. Wt. 172·4 grs. [B.M.C., No. 237.]

Obv.	Rev.
السلطان الغازي	سكندر الثاني
غياث الدنيا و الدين	يمين الخلافته ناصر
ابو المظفـر	اميرالمومنين

Margin : . . . . ضرب هذه السكه

This coin, described by Thomas as "the most curious hybrid piece in the entire series," is obviously struck from a new obverse die and an obsolete reverse stamp of 'Alāu-d-dīn Muḥammad. Unfortunately the margin fails to show the date; but the coin is clearly a freak and cannot be regarded as a normal issue of Tughlaq.

2. Wt. 170 grs., s. 1. Mint Dehli. Dates observed, 720 721, 722, 723, 724, 725. [B.M.C., No. 238.]

Obv. in double square.	Rev. in circle.
السلطان الغازي	تغلق شاه
غياث الدنيا و الدين	السلطان ناصر
ابو المظـفـر	امير المومنين

Margin (rev.) :

ضرب هذه السكه بحضرة دهلي في سنه عشرين و سبعماية

3. Wt. 170·1 grs., s. 1. Mint Dāru-l-Islam. [I.M.C., No. 217.]

Obv. in single square.	Rev. in circle.
السلطان الغازي	تغلق شاه
غياث الدنيا و الدين	السلطان ناصر
ابو المظفـر	امير المومنين

Margin (rev.) :

ضرب هذه الكسه بدار الاسلام في سنه اربع عشرين وسبعماية . . . .

Dated *muhars* of this type are rare. The die is usually too big for the coin, and the margin merely shows a portion of the legend. Mr. H. Nelson Wright has a specimen of 724 H.

4. Wt. 170 grs., s. 1. Mint Qila Deogīr. Dates 721, 722, H. [J.A.S.B., 1886, No. 3, p. 186.]

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Obv.	Rev.
in single square.	in circle.
السلطان الغازي	تغلق شـاه
غياث الدنيا و الدين	السلطان ناصر
ابو المظفـــر	امير المومنين

Margin (rev) :

ضرب هذه السكه بقلع ديوگير في سنه احدى عشرين و سبعمايه

No other dates but 721 and 722 are known. Deogīr remained in the hands of his son till the end of his reign, so that there is no reason to suppose that the mint ceased to work.

5. Wt. 171 grs., s. 1. Mint Mulk-i-Tilang. Date 724.

Obv.	Rev.
غياث الدنيا	in circle.
والدين ناصر	المتوكل على
امير المومنين	الله ابو المظفر
	تغلق شاه

Margin (rev.) :

ضرب هذه السكه فى ملک تلنگ سنه اربع و عشرين و سبعمايه

This remarkable and handsome coin has been long known, but the full margin is seldom seen. I have a perfect specimen in my own cabinet. The mint is the country of Telingāna and the coin was probably struck at Warangal, afterwards known as Sulṭānpur. The only known date is 724. A silver *tanka* of this mint in my possession was struck posthumously by Muḥammad bin Tughlaq in 725.

Silver.

6. Wt. 171 grs., s. 1. Mint Dehli. Dates observed, 720, 721, 722, 723, 724, 725.

Obv.	Rev.
in double square	in circle.
السلطان الغازى	تغلق شاه
غياث الدنيا و الدين	السلطان ناصر
ابو المظفر	امير المومنين

Margin (rev.) :

ضرب هذه السكه بحضرت دهلى فى سنه عشرين و سبعمايه

7. Wt. 2 grs., s. 15. Mint Deogir. Date 721.

[Thomas, No. 160.]

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Obv.	Rev.
as in (6).	as in (6).

Margin (rev.) :

ضرب هذه السکه بقلع دیوگیر فی سنه احدی عشرین و سعمایه

No other date has yet been observed. The coin is very rare, much more so even than the *muhar* of this mint.

8. Wt. 168·4 grs., s. 1. Mint Daru-l-Islam. Date 724. [J.R.A.S., 1900, p. 775.]

Obv.	Rev.
in single square.	in circle.
السلطان الغازی	تغلق شاه
غیاث الدنیا و الدین	السلطان ناصر
ابو المظفر	امیرالمومنین

Margin (rev.) : ..... بدار الاسلام فی سنه اربع .....

This is the only date known. The coin would have to be very large in order to show the complete margin.

Billon.

9. Wt. 56 grains, s. 6. Dates recorded, 720, 721, 722,723, 724, 725, 726, 727. [Thomas, No. 164.]

Obv.	Rev.
السلطان الغازی	ابو المظفر
غیاث الدنیا	تغلق شاه
والدین	السلطان ۷۲۰

These coins have a high silver content and probably represent one-eighth of the *tanka*. The only remarkable feature is that of the posthumous dates. Thomas considered these the work of an ignorant artificer. Mr. Nelson Wright inclines to this view, as "coins are found bearing the dates 716 and 717 as well as 726 and 727." [I.M.C. Vol. II, p. 49.]

10. Wt. 56 grains, s. 65. Dates recorded 720, 721. [Thomas, No. 163.]

Obv.	Rev.
السلطان الغازی	in Circle.
غیاث الدنیا	شاه
والدین ۷۲۰	تغلق

Margin : खो सुलतां गयासुदीं ।

Only two dates are known. These coins contain less silver than No. 9, and may be regarded as one-sixteenth of the *Tanka*.

11. Wt. 56 grains, s. 6. [I.M.C. No. 296.]

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Obv.	Rev.
السلطان الا	in double circle.
عظم غياث الدنيا	شاه
والدين	تغلق

Margin : ... سلطان الغازى ... ...

The marginal legend of these coins has yet to be read. Probably it contains a date in addition to the two words given above, the reading of which is conjectural. I have examined a large number of specimens, but have never yet found one with sufficient margin to afford a safe guide.

Copper.

12. Wt. 70 grs., s. 6. [R. B. Whitehead.]

Obv.	Rev.
غياث الد	السلطان
نيا و الدين	الغازى

13. Wt. 62 grs., s. 65. [Lahore Mus. Cat. p. 137.]

Obv.	Rev.
غياث الدنيا	السلطان
والدين	الاعظم

Mr. Rodgers classifies these as South Indian coins.

14. Wt. 56 grs., s. 5. [Thomas, No. 165.]

Obv.	Rev.
تغلق	شاه

The weight of these coins varies greatly, from 45 to 56 grains; but obviously they are intended to be pieces of 32 *ratis* or 56 grains.

Simla, 1920 H. Nevill.

222. Coins of the Pathan Kings of Dehli.

Fīroz Shāh and the later Tughlaqs.

In this field a large advance has been made since Edward Thomas published his Chronicles. There are yet many discoveries to be made. Fīroz Shāh reigned for nearly forty years, but so far only three of his rupees, and these of a single year and type, have come to light. The earliest dated coin of his is a gold piece of 757 H. and apart from this no earlier date is known than 759 H.; a fact which supports the theory that Fīroz continued to strike billons in the name of Al Ḥakim Abū-l-'Abbās Aḥmad, similar to those of his predecessor, for the first seven years of his reign. In the case of other rulers,

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यह पुस्तक वितरित न की जाय
NOT TO BE ISSUED

we have still to see a *muhar* of 'Alā-ud-din Sikandar, and rupees of the same short-lived ruler, as well as those of Abū-bakr, Tughlaq II and Ẓafar; while in other directions surprises may yet await us.

I. Ghiaṣu-d-dīn Maḥmūd (Pretender), A.H. 752.

The supposititious son of Muḥammad bin Tughlaq, placed on the throne with the best of intentions, but with disastrous results, by Khwāja-i-Jahān during the absence of Fīroz Shāh in Sind, appears to have struck gold in large quantities, for his coins, despite the shortness of his reign, are relatively common. No silver, billon or copper coins of this pretender have come to light, but their discovery might well be expected.

Gold.

1. A.H. 752 (wt. 170 s. ·775). [B.M.C., 342.]

Obv.	Rev.
يمين	محمود شاه
امير المومنين	بن محمد شاه بن
غياث الدنيا و الدين	تغلقشاه السلطان
ابو المظفر	٧٥٢

II. Fīroz Shāh, A.H. 752—790.

Few additions have to be made to the list of coins attributed by Thomas to Fīroz Shāh. No new gold types have come to light, but the silver *tanka*, the existence of which was not credited by Thomas, has been found, and there is no apparent reason why other specimens corresponding to all the known types in gold should not be discovered in due course. In billon the list remains practically unaltered. Specimens of the minute coin illustrated by Thomas (No. 232) have been found, after the lapse of many years; while in copper the main addition is that of the heavy *jaitil*, published for the first time by Rodgers in his catalogue of coins sold to the Punjab Museum.

Gold.

A. With the name of Abū-l-'Abbās Aḥmad Khalīfa.

1. No date, no mint (wt. 170 grs., s. ·85).
[I.M.C., No. 407.]

Obv. in eight-foil.	Rev. in eight-foil.
ضربت هذه السكه	وافق بتاييد
فى زمان الامام	يزداني فيرور شاه
ابوالعباس احمد	سلطانى
خلدت خلافته	

[Thomas, No. 223.]

यह पुस्तक वितरित न की जाय
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B. With the name of Abu-l-Fatḥ Khalīfa.

2. No mint, no date (wt. 169 grs., s. ·85).

[I.M.C., No. 410.]

Obv.	Rev.
ضربت هذه السكه	السلطان الاعظم
في زمن الامام امير المومنين	سيف امير المومنين
ابو الفتح المعتضر بالله	ابو المظفر فيروز شاه
خلدت خلافته	السلطاني خلدت مملكته

[Thomas, No. 225.]

Note.—These coins differ widely in size and execution. In some the area is large and in others it is small, while the legend is sometimes in fine delicate script and sometimes in broad and comparatively coarse lettering.

3. Mint Ḥazrat Dehlī, with date in margin. The only recorded dates are 757 H.(B.M.) and 759 (I.M.). Wt. 170 grs., s. ·9. [I.M.C., No. 408.]

Obv. in circle	Rev.
الامام	السلطان الاعظم
في زمن ابو	سيف امير المومنين
امير المومنين	ابو المظفر فيروز شاه
الفتح خلدت	السلطاني خلدت
خلافته	مملكته

Margin : ضرب هذه السكه بحضرت دهلي سنه تسع و خمسين و سبعمايه

[Thomas, No. 224.]

4. Variant of No. 3. [B.M.C.].

Obv.	Rev.
في زمن الامام	as (3).
امير المومنين ابو الفتح	
خلدت خلافته	

Margin : illegible.

C. With the name of Abī 'Abdullah Khalīfa.

5. Mint Ḥazrat Dehlī, with date in margin. Known dates are 766 (I.M.C.) and 771 (H. R. Nevill). Wt. 169·5 grs., s. ·85. [I.M.C., No. 411.]

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Obv. in circle.	Rev.
في زمن الا مام	السلطان الا عظم
امير المومنين	سيف امير المومنين ابو
ابي عبد الله	المظفر فيروز شاه
خلدت خلافته	السلطاني خلدت
	مملكته

Margin : ضربت هذه السكه بحضرت دهلي سنه ست وستين و سبعمايه

[Thomas, No. 226.]

NOTE.—In the coin of 771 H. the obverse is differently arranged thus :—

في زمن الامام
امير المومنين ابي
عبد اللّٰه خلدت
خلافته

Margin : ضربت هذه السكه بحضرت دهلي ثلاث و سبعين و سبعمايه

[The سنه being omitted.]

D. Without the name of a Khalifa.

6. No mint. Recorded dates 785 (I.M.C.) 786 (H. R. Nevill), 787 (R. B. Whitehead) 788 (B.M.), 789 (I.M.C.) Wt. 173 grs., s. ·85. [I.M.C., No. 412.]

Obv.	Rev.
سلطانى	المومنين
فيروز شاه	نائب امير
	٧٨٥

[Thomas, No. 227.]

Silver.

Type C. With the name of Abī 'Abdullah Khalīfa.

7. Mint Ḥaẓrat Dehlī, with date in margin. Wt. 170 grs., s. 1, date 773 H. (H. R. Nevill).

Obv. in circle.	Rev.
فى زمن الا مام	السلطان الا عظم
امير المومنين ابي	سيف امير المومنين ابو
عبد الله خلدت	المظفر فيروز شاه
خلافته	السلطانى خلدت
	مملكته

Margin : ضربت هذه السكه بحضرت دهلي سنه ثلاث و سبعين و سبعمايه

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Billon.

(*a*) Large billons, weight from 138 to 143 grains, size circ. ·75.

8. Mint Ḥaẓrat Dehlī, date 759 on reverse. *Vide* J.R.A.S. 1900, p. 488 (H. Nelson Wright).

Obv.	Rev.
الخليفه امير	فيروز شاه
المومنين خلدت	سلطاني ضربت
خلافته	بحضرت دهلي
	٧٥٩

9. Mint Ḥaẓrat Dehlī, dates 759, 760, 761, 762, 763, 764, 765, 766, 767 also 827, 828, 830. [Struck by Mubārak Shāh.]

Obv.	Rev.
الخلفيه امير	فيروز شاه
المومنين خلدت	سلطانى ضربت
خلافته ٧٥٩	بحضرت دهلي

[Thomas, No. 228.]

10. Mint Ḥaẓrat Dehlī, dates 765, 766, 767, 768. [One specimen 868 (!)]

Obv.	Rev.
الخليفه امير	فيروز شاه
المومنين خلدت	سلطانى ضربت
خلافته ٧٦٥	بحضرت دهلى

Note.—In this type the tail of the "ye" strikes obliquely across the ṭoe and alif of "Sulṭānī."

11. Mint Ḥaẓrat Dehlī, dates 768 to 784 inclusive. Also 816, 817, 820, 824, 825, 828, 830 (struck by Daulat Khān Lodï, Khiẓr Khān and Mubārak Shāh.)

Obv.	Rev.
الخليفه امير	وز شاه
المومنين خلدت	فـــيـــــر
خلافته ٧٦٨	سلطانى ضربت
	بحضرت دهلى

12. Mint Ḥaẓrat Dehlī, dates 784 to 790 inclusive.

Obv.	Rev.
الخليفه ابو	وز شاه
عبد الله خلدت	فـــيـــــر
خلافته ٧٨٤	سلطانى ضربت
	بحضرت دهلى

[Thomas, No. 230.]

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13. Mint Sāḥat-i-Sind, no date.

Obv.	Rev.
الخليفه	شاه
امير المومنين	فيـــروز
خلدت خلافته	السلطـــانى
	ضربت بساحت
	سند

(*b*) Billons of 56 grains, s. ·55 circ.

14. No mint, with name of Abū-l-'Abbās Aḥmad.

Obv. in six-foil.	Rev. in six-foil.
احمد	فيروز شاه
العباس	سلطانے
ابو	

[Thomas, No. 235.]

15. No mint, with name of Abu-l-Fatḥ.

Obv. in circle.	Rev. in circle.
الخليفه	فيروز شاه
ابو الفتح	سلطاني
خلدت خلافته	خلد ملكه

[Thomas, No. 229.]

Note.—A variety has * above الخليفه

16. Mint Ḥaẓrat Dehlī, dates observed 759 (B.M.) 762.

Obv.	Rev.
الخليفه	فيروز شاه
المومنين	السلطاني ضربت
اميـــــر	بحضرت دهلي
خلدت خلافته	٧٦٢

17. Mint Ḥaẓrat Dehlī, no date.

Obv. in circle.	Rev. in circle.
الخليفه	فيروز شاه
المومـــنين	سلطانے ضربت
امـــــير	بحضرت دهلے
خلدت خلافته	as in No. 10.

18. Mint Ḥaẓrat Dehlī, no date.

Obv. in circle.	Rev. in circle.
الخليفه	وز شاه
المومنين	فيـــــــر
امـــــــير	سلطانے ضربت
خلدت خلافته	بحضرت دهلے

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19. Mint Ḥaẓrat Dehlī, no date, with name of Abū 'Abdullah.

Obv.	Rev.
الخليفه	وز شاه
ابو عبد الله	فيـــــر
خلافت خلافته	سلطانى ضربت
	بحضرت دهلى

(*c*) Billon of 84 grains, in name of Abū-l-Fatḥ s. 6.

20. [Thomas, No. 236. I.M.C., No. 450.]

Obv. in circle.	Rev. in circle.
خليفه	فيروز
ابو الفتح	سلطانى

[Thomas, No. 236.]

(*d*) Billon of 49 grains, in name of Abū-l-Fatḥ.

21. [Rodgers, J.A.S.B., 1894, No. 2, p. 65.]

Obv. in six-foil.	Rev. in six-foil.
خليفه	سلطاني
ابو الفتح	فيروز

A star * above خليفه.

(2) Billon of 35 grains.

22.

Obv. in circle.	Rev. in circle.
فيروز	ت
سلطانى	حضـــــر
	دهلي

[Thomas, No. 231.]

(*f*) Billon of 17·5 grains.

23.

Obv. in circle	Rev. in circle.
شاه	
وز	دهلي
فيـــر	

[Thomas, No. 232.]

Copper.

(*a*) Large copper *jaitil*, mint Dehlī, circ. 140 grs.

24. [Rodgers, Lahore Museum Cat., p. 98.]

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Obv. in circle.	Rev. in circle.
وز شاه	دارالملک
فیـــــر	دهلي
سلطانے	

(*b*) Smaller copper, mint Dehlī, circ. 70 grains.

25.

Obv. in circle.	Rev. in circle.
وز شاه	دارالملک
فیـــــر	دهلي
سلطانے	

[Thomas, No. 233.]

These coins differ greatly in size, shape and appearance. The earlier issues correspond more closely to the earlier billon types, while the latest are crude, and at once suggest the type shortly afterwards adopted by Hoshang Shāh of Mālwa.

26 A similar coin, but in double circles, possibly posthumous. [I.M.C., No. 455.]

Obv.	Rev.
وز شه	دارالملک
فیـــــر	دهلي
سلطانے	

(*c*) Copper coins of 56 grains, mint Dehlī.

27. I.M.C., No. 45, s. 5.

Obv.	Rev.
سلطاني	دهلے
فیروز	حضرت

(*d*) Copper coins of 35 grains, mint Dehlī.

28.

Obv.	Rev.
وز شاه	حضرت
فیـــــر	دهلي
سلطانے	

[Thomas, No. 234.]

(*e*) Posthumous copper coins, dates recorded 799, 800, 818, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830.

29. S ·5, average weight 68 grains.

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Obv.	Rev.
وز شاه	دارالملک
فيـــــر	دهلي
ـــــنے	۸۱۸
سلطا	

[Thomas, No. 239.]

NOTE.—It would appear that some of these coins were struck in the days of Maḥmūd Shāh. Thomas mentions large billons of the type No. 11 of the years 791, 799 and 800. These cannot be explained, but it is clear that after the death of Maḥmud the coinage of Fīroz Shāh and Muḥammad, the latter in silver, was utilised until Mubārak began to issue coins in his own name.

III. Fath Khān Fīroz Shāh.

It now seems clear that Fīroz Shāh, in granting the insignia of sovereignty and the right of coinage to his eldest son, Fath Khān, did so by virtue of his appointment of that prince to the viceroyalty of the eastern portion of his dominions. In this way Fīroz originated the separate principality known as the Iqlīmu-sh-sharq, which not long afterwards became the independent kingdom of Jaunpūr. It is certain that the young prince resided for a time at Jaunpūr, but it is by no means proved that this city was the capital of the viceroyalty, and a tentative reading of the coin in the Indian Museum suggests that Patna was at first intended to be the headquarters. Thomas states that Fath Khān was given regal powers in 760 and that he died in 776. The latter date is certainly incorrect. The only known date on any of his coins is 761, so that there are no means of proving the date of his death by numismatic evidence.

Gold.

1. A.H. 761. Mint, Iqlimu-sh-sharq (wt. 170 grs., s.·9.)

Obv. in circle.	Rev. in circle
فی زمن الا مام	شاه
امیر المومنین ابی	فتحخان فیروز
الفتح المعتضد بالله	جل اللّٰه ظلال
خلدت خلافته	جلاله

Margin : ضربت هذه السکه در اقلیم الشرق سنه ی و ستین وسبعمایه

This legend is taken from a coin in my own collection. Mr. H. Nelson Wright and Mr. R. B. Whitehead have others,

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but in the case of my coin the execution is remarkably good, as fine as that on any coin of Muḥammad ibn Tughlaq, and vastly superior to that of other gold coins of Fatḥ Khān that I have seen. Thomas describes his currency as provincial in appearance and experience bears out this verdict; but it would seem that the issues degenerated unless this particular piece was struck as a specimen by a craftsman from the imperial capital.

2. A.H. 761. Mint (?) Shahr Patna. [I.M.C., No. 462.] Wt. 169·2 grs., s. ·8.

Obv. in circle.

في زمن الا مام
امير المومنين ابى
الفتح المعتضد بالله
خلدت خلافته

Rev. in double circles.

شاه
فتحخان فيروز
جلّ اللّٰه ظلال
جلاله

a star above فيروز

Margin : هذه السكه في الشهر پتنه في سنه احدى و [Tentative reading.]

3. Date and mint illegible.

[Rodgers, J.A.S.B., 1886, No. 3, p. 186.]
Wt. 170 grains.

Obv. in circle.

في زمن الا مام
المو ايي عبد اللّٰه
امير منين
خلدت خلافته

Rev.

الشرق و الغرب
حبيب شاه
فتحخان فيروز
جلّ اللّٰه ظلاله

.....

Margin :— ضربت هذه السكه ..... و سبعمايه

This remarkable coin is manifestly later than the others. It must be later than 763 H. and it might be urged that owing to the elaboration in the title of the prince, his viceroyalty had been changed for that of the western provinces, a charge which was unquestionably held at one time by his younger brother Ẓafar. The coin passed into the possession of General Cunningham and I have not been able to trace its present whereabouts.

Billon.

These coins are of two denominations only, one being a large billon of some 140 grains and the other a small coin of the usual 56 grains or 32-*rati* type. The variations are unimportant.

4. Wt. 142 grs., s. ·7. [I.M.C., No. 463.]

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Obv.
في زمن الا مام
امير المومنين ابي
الفتح المنضد بالله
خلدت خلافته

Rev.
شاه
فتحخان فيروز
جلّ الله ظلال
و جلاله

5. Wt. 142 grs., s. ·7. [I.M C., No. 465.]

Obv.
في زمن الا مام
امير المومنين ا ى
عبد الله خلدت
خلافته

Rev.
as in 4.

6. Wt. 139 grs [Thomas, No. 244.]

Obv.
as in 5.

Rev.
شاه
فتحخان فيروز
جلّ ظلال جلا له
ضربت هذه
السكه

7. Wt. 54 grs., s. ·55. [I.M.C., No. 467.]

Obv.
في زمن الا مام
امير المومنين
ابو الفتح خلدت
خلافته

Rev.
شاه
فتحخان فيروز
جلّ الله ظلال
و جلاله

8. Wt. 55 grs., s. ·55.

Obv.
الامام
في زمن
امير المومنين
خلدت خلافته

Rev.
as in 7.

IV. Ghiāṣu-d-dīn Tughlaq ibn Fath Khān Fīroz Shāh, A.H. 790—791.

The heir to the throne of Fīroz by right of primogeniture established himself in Dehlī after the death of his grandfather, in opposition to his uncle Muḥammad, who for some time had

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held the office of prince regent. His reign was short, less than two years in duration, but the number and variety of his coins is remarkable. No silver pieces have yet come to light, and his gold is extremely rare. He was assassinated by the partisans of his uncle Ẓafar on the 21st of Safar A.H. 791.

Gold.

1. Wt. 169·2 grains, s. ·8
[Rodgers, J.A.S.B., 1894, Pt. I, p. 67.]

Obv. in circle.	Rev.
الامام	السلطان الاعظم
في زمن	غياث الدنيا و الدين
امير المومنين	تغلق شاة
ابي عبد الله	سلطاني
خلدت خلافته	

Margin (read from outside): ..... حضرت دهلي .....

Billon.

2. Wt. 164 grs., s. ·8. Dates 790, 791.
[Thomas, No. 251.]

Obv.	Rev.
سلطانے	المومنين
تغلق شاه	نائب امير
	٧٩٠

3. Wt. 72 grains. Mint Dehli. Date 790.
[J.R.A.S., 1900, p. 489.]

Obv. in circle.	Rev.
اللّٰه	سلطانے
عبد	تغلق شاه
ابو	

Margin: خلدت خلافته بحضرت دهلي

Note.—The larger size in this type has not yet been found, but its issue may be presumed on the analogy of the billon of Muḥammad ibn Fīroz.

4. Wt. 140 grains, s. ·7. Mint Dehlī. Dates 790, 791.
[Thomas, No. 250.]

Obv.	Rev.
الخليفه ابو	تغلق شاه
عبد اللّٰه خلدت	سلطانے ضربت
خلافته ٧٩٠	بحضرت دهلے

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5. Wt. 80 grains, s. ·6. No date or mint.
[Thomas, No. 252.]

Obv.	Rev.
الله	تغلق شاه
ابو عبد	سلطانی خلدت
خلدت خلافته	ملکه

6. Wt. 55 grains, s. ·5. Dehlī, no date.
[J.A.S.B., 1894, No. 2, p. 70.]

Obv.	Rev.
الخليفه	تغلق شاه
المومنين	سلطانی ضربت
امير	بحضرت دهلي
خلدت خلافته	

7. Wt. 53 grains, s. ·5. No mint or date.
[Lahore Mus. Cat., p. 102.]

Obv.	Rev.
الخليفه	تغلق شاه
ابو عبد الله	سلطانی
خلدت خلافته	خلد ملکه

8. Wt. 50 grs. Date 790. [Thomas, No. 254.]

Obv.	Rev.
ابو	تغلق شاه
عبد الله	سلطانی
٧٩٠	

Copper.

9. Wt. 70 grains, s. ·5. Mint Dehlī. [Thomas, No. 254.]

Obv.	Rev.
تغلق شاه	دارالملک
سلطانی	دهلي

10. Wt. 66 grains, s. ·5. Mint Dehlī.
[Lahore Mus. Cat., p. 102.]

Obv.	Rev.
سلطانی	دارالملک
تغلق شاه	دهلي

11. Wt. 35 grains, s. ·4. Mint Dehlī.
[Lahore Mus. Cat., p. 102.]

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Obv.	Rev.
شاه	حضرت
تغلق	دهلي

V. Fīroz Shāh Ẓafar ibn Fīroz Shāh, A.H. 791.

There is nothing to prove the assumptions of Thomas that Ẓafar, the second son of Fīroz, was associated with his father in the kingship; but coins show clearly that a king styled Fīroz Shāh Ẓafar, son of Fīroz Shāh, ruled in Dehlī in 791. The inference is that this Sulṭān, who was the father of Abūbakr, reigned for a short period and died, being succeeded by Abūbakr in the same year in which he came to the throne. I have discussed this question already, and see no reason for departing from the order of succession here adopted. The coins of Ẓafar are varied and numerous. No silver piece has yet been unearthed, but this and other types may fairly be expected.

Gold.

1. Wt. 169 grains, s. ·85. Mint Dehlī. Date 791. [H. R. Nevill.]

Obv. in circle.	Rev.
الامام	السلطان الاعظم
في زمن	فيروز شاه ظفر
امير المومنين	ابن فيروز شاه
ابي عبد الله	السلطاني
خلدت خلافته	

Margin (read from outside) : ضربت ..... دهلي سنه ۷۹۱

Billon.

2. Wt. 165 grains s. ·8. Date 791. [Lahore Mus. Cat., p. 100.]

Obv.	Rev.
فيروز شاه	المومنين
ظفر ابن	نائب امير
فيروز شاه	۷۹۱

3. Wt. 140 grains, s. ·7. Date 791. Mint Delhī. [Thomas, No. 247.]

Obv.	Rev.
الخليفه ابو	وز شاه
عبد الله خلدت	فيـــــــر
خلافته ۷۹۱	ظفر سلطاني ضربت
	بحضرت دهلي

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4. Wt. 140 grains, s. ·7. Mint Dehlī, No date.
[Thomas, No. 246.]

Obv.	Rev.
الخليفه	وز شاه
المومنين	فيـــــــر
اميـــــــر	ظفر سلطاني ضربت
خلدت خلافته	بحضرت دهلي

5. Wt. 110 grains, s. ·65. Date 791.
[J.A.S.B., 1880, No. 2, p. 83].

Obv.	Rev.
in square.	المومنين
شاه	نائب امير
فيروز	٧٩١

In margin: ظفر ابن فيروز شاه سلطاني

Note.—The marginal legend is differently arranged in different coins, ظفر being some times on the top, and sometimes on the left.

6. Wt. 80 grains, s. ·6. [Thomas, No. 248.]

Obv.	Rev.
الله	فيروز شاه
ابو عبد	ظفر ابن
خلدت خلافته	فيروز شاه

7. Wt. 73 grs. (worn). [R. B. Whitehead.]

Obv. (in circle.)	Rev.
الله	وز شاه
عبد	فيـــــــر
ابو	ظفر ابن
	فيروز شاه

Margin: ..... خلدت خلافته ضربت

8. Wt. 55 grains, s. ·55. [B.M.C., No. 39.]

Obv.	Rev.
الخليفه	فيروز
ابو عبد الله	شاه ظفر
خلدت خلافته	سلطاني

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9. Wt. 55 grs., s. ·55. [Lahore Mus. Cat., p. 100.]

Obv.	Rev.
وز شاه	المومنين
فيـــــروز	نائب امير
ظفر ابن	٧٩٠
فيروز شاه	

NOTE.—The date on this coin is uncertain.

Copper.

10. Wt. 130 grs. [Rodgers, J.A.S.B., 1896, No. 2, p. 271.]

Obv.	Rev.
الخليفه	وز شاه
المومنين	فيـــــر
اميـــــر و	سلطاني
خلدت خلافته	ظـــفـــر
	٧٩١

NOTE.—This is not a copper type, unusual as it is. The present whereabouts of the coin is unknown.

11. Wt. 110 grs , s. ·6. [I.M.C., No. 472.].

Obv.	Rev.
in circle.	الخليفه
شاه	ابو عبد الله
فيـــروز	خلدت خلافته

Margin : ظفر بن فيروز شاه سلطاني

These coins are very crudely formed, and the whole of the margin seldom appears on any one piece. The average weight of five coins according to Rodgers was 84 grains, and possibly the heavier coin at Calcutta may belong to a higher denomination. Mr. Nelson Wright gives no. 7 as a copper coin. In this he follows Thomas, but no. 249 of Thomas is either a different coin or the weight, 78 grains, is incorrect. The coin described as no. 7 is certainly of billon, and this view was accepted by Rodgers. No smaller coppers of Ẓafar have yet come to light except the following :—

12. Wt. 67 grs., s. ·55. Mint Dehli.

[R. B. Whitehead, J.A.S.B. Num. Supp., No. 83, 1914.]

Obv.	Rev.
وز شاه	دارالملک
فيـــــر	دهلي
ظفر سلطانى	

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VI. Abūbakr ibn Fīroz Shāh Ẓafar, A.H. 791—792.

In spite of doubts arising from the reading of certain coins, it appears beyond question that every piece bearing the name of Abūbakr was struck by a single king, and that it is unnecessary to invent, without a trace of historical support, a son of Abūbakr under the name of Fīroz Shāh, merely to satisfy an impression caused by an imperfectly designed die. According to Thomas, the reign of Abūbakr ended with the loss of Dehlī in 792, but the actual surrender to Muhammad did not take place till Muharram 793. This fact may account for the appearance of the coin (No. 255) quoted by Thomas with the date 793, and if this date is correct, the piece must have issued from a camp mint. No silver coin of Abūbakr is known, but his billons and coppers exhibit a large variety.

Gold.

1. Wt. 171 grs., s. ·8. Mint Dehli Date 792.
[H. R. Nevill.]

Obv. in circle.	Rev.
الامام	السلطان الاعظم
في زمن	ابو بكر شاه بن ظفر
امير المومنين	بن فيروز شاه
ابي عبد الله	السلطاني
خلدت خلافته	

Margin (read from outside): ضربت ..... دهلي ٧٩٢

2. Wt. 165 grs., s. 6. [J.R.A.S., 1900, p. 489.]

Obv.	Rev.
ابوبكر شاه	المومنين
ظفر ابن	نائب امير
فتروز شاه	٧٩٢

Billon.

3. Wt. 140 grains, s. ·65. Dates recorded, 791, 792, 793.
[Thomas, No. 255.]

Obv.	Rev.
الخليفه ابو	ابوبكر شاه
عبد الله خلدت	بن ظفر بن فيروز شاه
خلافته ٧٩٢	سلطاني

4. Wt. 136 grs., s. ·7. Date 791. Mint Dehli.
[I.M.C. No. 480.]

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Obv.	Rev.
الخليفه ابو	ابو بكر شاه
عبد الله خلدت	بن ظفر بن فيروز شاه
خلافته ٧٩١	سلطانے بعضرت دهلي

5. Wt. 110 grs., s. ·7. Date 791. [J.A.S.B., 1896, No. 2, p. 215.]

Obv.	Rev.
in quatrefoil	المومنين
شاه	نائب امير
ابوبكر	٧٩١

Margin : ظفر بن فيروز شاه سلطان

6. Wt. 110–114 grs., s. ·7. Date 792. [Thomas, No. 257.]

Obv.	Rev.
in square.	المومنين
شاه	نائب امير
ابو بكر	٧٩٢

Margin : بن ظفر بن فيروز شاه سلطاني

These coins are said by Thomas to be of copper. Some are undoubtedly billon. There are three varieties, one with ظفر in the top margin, a second with ظفر at the bottom, and the third with this name on the left. The first is unmistakeably of billon, but though the others appear to be of copper, I hesitate to think that a difference in the marginal arrangement indicates coins of different denominations.

7. Wt. 110 grs., s. ·7. Date 792. [H. R. Nevill.]

Obv.	Rev.
in quatrefoil.	as in 5.
شاه	
بن فيروز	
ابو بكر	
شاه	

Margin : ظفر ..... سلطاني

See no. 11. It is a pity that the margin of this newly discovered coin is so defective, as it would solve the problem which puzzled Rodgers. I have little doubt that the full legend is :—

* ابو بكر شاه بن فيروز شاه ظفر بن فيروز شاه سلطاني

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8. Wt 55 grs , s. ·5. [Thomas, No. 260.]

Obv.
الخليفه
ابو عبد الله
خلدت خلافته

Rev.
ابو بكر
شاه ظفر
سلطاني

9. Wt. 55 grs., s. ·56. [B.M.C., No. 408.]

Obv.
الخليفة
المومنين
امير
خلدت خلافته

Rev.
ابو بكر شاه
بن فيروز شاه
ظفر بن
سلطاني

10. Wt. 47 grs. [Thomas, No. 256.]

Obv.
الخليفه
ابو عبد الله
خلدت خلافته

Rev.
ابوبكر شاه
بن ظفربن فيروز شاه
سلطاني

Copper.

11. Wt. 165 grs., s. ·7. [Thomas, No. 259.]

Obv.
ابوبكر شاه
بن فيروز شاه
ظفر
سلطانى

Rev.
نائب
المومنين
امير
خلدت خلافته
٧٩٢

12. Wt. 167 grs. [J.A.S.B., 1896, No. 2, p. 215.]

Obv.
وز شاه
فير
ابوبكر شاه
بن
سلطاني

Rev.
المومنين
نائب امير
٧٩٢

The arrangement on this peculiar coin has been taken by Rodgers to show that Abūbakr was succeeded by his son Fīroz, but possibly the name Ẓafar has disappeared owing to a faulty arrangement of the lettering, or else the die was defective.

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These large copper coins are interesting, as they represent the full theoretical weight of the *jaitil*, and foreshadow the reform carried out by Mubārak Shāh. The following coin lends strength to the theory that Ẓafar was placed on the throne temporarily, pending the arrival in Dehli of his father.

13. Wt. 128 grs. [J.A.S.B., 1896, No. 2, p 216.]

Obv.	Rev.
وز شاه	ابوبكر شاه
فيـــــــر	بن فيروز شاه
سلطاني	ظفـــــــر
ظـــــفـــــر	سلطاني
٧٩١	

14. Wt. 76 grs., s. ·6. [Lahore Mus. Cat., p. 103.]

Obv.	Rev.
ابو	ابوبكر
عبد الله	شاه ظفر
خلدت خلافته	سلطاني

15. Wt. 155 grs., (a worn coin). [Thomas, No. 258.]

Obv. (in circle.)	Rev.
شاه	المومنين
ابو بكر	نائب امير
Margin : فيروز شاه	٧٩٢

16. Wt. 56 grs., s. ·5. [Lahore Mus. Cat., p. 103.]

Obv.	Rev. in circle.
الخليفه ابو	بكر
عبد الله	ابو

Margin : بن ظفر بن فيروز شاه

VII. Nāṣiru-d-dīn Muḥammad ibn Fīroz Shāh.

The third son of Fīroz Shāh was appointed deputy to the Sulṭān during his latter days, and was associated with his father in the sovereignty after the downfall of Khān-i-Jahān in Rajab 789 H. He attempted to secure the throne for himself after the death of Fīroz, but was ejected from Dehli by the supporters of Tughlaq II in 790, and remained in opposition till the month of Ramẓan 792, when he again entered the capital. His reign as sole ruler, therefore, lasted from the end of

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792 till his death in 795, and no coins of his are known bearing the date 791, while those of 792 are very rare. His silver coins were also struck posthumously in 817 and 818, specimens of both years being in the British Museum.

Gold.

1. Wt. 170 grains, s. ·75. Recorded dates 793, 794.

Obv.	Rev.
الامام	السلطان الاعظم
في زمن	شاه شاه
المومنين	محمّد فيروز
اميـــــــر	سلطاني خلدت
خلدت خلافته	مملكته
٧٩٣	

Silver.

2. Wt. 167–174 grains, s. 85—·9. Recorded dates 793, 794, 817, 818.

Obv.	Rev.
الامام	السلطان الاعظم
في زمن	ابو المحامد محمّد شاه
المومنين	بن فيروز شاه
اميـــــــر	سلطاني
خلدت خلافته	
٧٩٣	

Billon.

3. Wt. 167 grs. Date 790. [Thomas, No. 261.]

Obv. in circle.	Rev.
الله	سلطان
عبد	فيروز شاه
ابو	محمد شاه

Margin : خلدت خلافته ضربت بحضرت دهلي ٧٩٠

4. Wt. 175 grs., s. ·8. Dates 790, 795.
[Rodgers, J.A.S.B., 1886, No. 3, p. 187, and H. R. Nevill.]

Obv.	Rev.
سلطان	المومنين
فيروز شاه	نائب امير
محمّد شاه	٧٩٠

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5. Wt. 132 grs., (worn) s. ·65. [R. B. Whitehead.]

Obv.	Rev.
شاه	المومنين
فيروز	نائب امير
بن	٧٩ ×
محمّد شاه	

6. Wt. 140 grs., s. ·68. Dates recorded 789, 790, 793, 794, 795.

Obv.	Rev.
الخليفه ابو	سلطانى
عبد اللّه خلدت	فيروز شاه
خلافته ٧٨٩	محمّد شاه

7. Wt. 55 grs., s. ·55. No date. [Thomas, No. 269.]

Obv.	Rev.
الخليفه	السلطان
ابو عبد اللّه	فيروز شاه
خلدت خلافته	محمّد شاه

8. Wt. 55 grs., s. ·55. No date.

Obv.	Rev.
الخليفه	سلطانى
ابو عبد اللّه	فيروز شاه
خلدت خلافته	محمّد شاه

9. Wt. 55 grs., s. ·55. No date.

Obv.	Rev.
الخليفه	سلطانى
المومنين	فيرور شاه
امير	محمّد شاه
خلدت خلافته	

Copper.

10. Wt. 106 grs., s. ·6.

[J.A.S.B., Num. Supp. XIV, No. 83, vii, R. B. Whitehead.]

Obv.	Rev.
سلطانى	دارالملک
فيروز شاه	دهلي
محمّد شاه	٧٩٠

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11. Wt. 140 grs., s. ·68. Mint Dehli. Dates recorded 793, 794, 795.

Obv. in circle.	Rev.
شاه	المومنين
محمّد	نائب امير
	٧٩٣

Margin : سلطاني ضربت بحضرت دهلي

12. Wt. 55 grs., s. ·55. Dates recorded 792, 793, 794.

Obv. in circle.	Rev.
شاه	المومنين
محمد	نائب اميـــر
	٧٩٢

13. Wt. 70 grs., s. ·5. No date. [Thomas, No. 262.]

Obv.	Rev.
وز شاه	سلطانے
فيـــــــر	محمّد شاه
سلطانے	

14. Wt. 35 grs., s. ·45.
[Rodgers, Lahore Mus. Cat. p. 105.]

Obv.	Rev.
وز شاه	سلطانے
فـــيـــر	محمّد شاه
سلطانے	

15. Wt. 70 grs., s. ·5. Mint Dehli, dates 793, 794, 795.

Obv.	Rev.
سلطانے	دارالملک
محمد شاه	دهلي
	٧٩٣

16. Wt. 70 grs., s. ·55. Mint Dehli. No date.

Obv. in circle.	Rev. in circle.
سلطان	دارالملک
محمّد شاه	دهلي

17. Wt. 42 grs., s. ·55. Mint Dehli.
[Lahore Mus. Cat., p. 104.]

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Obv.	Rev.
شاه	بحضرت
محمّد	دهلي

18. Wt. 24 grs., s. ·35. Mint Dehli. [Thomas, No. 268.]

Obv.	Rev.
شاه	ت
محمّد	بحضـر
	دهلي

19. Wt. 16 grs., s. ·35. [J.A.S.B., 1880, No. 2, p. 84.]

Obv.	Rev.
محمّد	شاه

VIII. 'Alāu-d-dīn Sikandar ibn Muḥammad Shāh, A.H. 795.

This ruler occupied the throne for only 45 days, a fact which necessarily makes his coins uncommon, though it is surprising that so many varieties should be known. These number two billon and four copper types.

Billon.

1. Weight 142 grs. [B.M.C., No. 424.]

Obv.	Rev.
الخليفه ابو	سلطانى
عبد اللّه خلدت	محمّد شاه
خلافته ٧٩٥	سكندر شاه

2. Weight 55 grs. [B.M.C., No. 429.]

Obv.	Rev.
الخليفه	سلطانى
المومين	محمّد شاه
امير——ر	سكندر شاه
خلدت خلافته	

Copper.

3. Weight circ. 140 grs., s. ·65. [B.M.C., No. 425.]

Obv. in circle	Rev.
شاه	المومنين
سكندر	نائب امجر
	٧٩٥

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Margin : سلطاني ضرب بحضرت دهلي

4. Weight 66 grs., s. ·58. [B.M.C., No. 427.]

Obv.	Rev.
سلطانى	دارالملک
سكندر شاه	دهلي
	٧٩٥

5. Weight 35 grs., s. ·48. [Thomas, No. 275.]

Obv.	Rev.
شاه	بحضرت
سكندر	دهلي

6. Weight 18 grs., s. ·4.

[Rodgers, Lahore Museum Catalogue, p. 106.]

Obv.	Rev.
سكندر	شاه

IX. Nāṣiru-d-dīn Maḥmud Shāh ibn Muḥammad Shāh, A.H. 795-815.

It is remarkable that Thomas makes no mention of the gold coins of Maḥmud, as no fewer than three distinct types are known. Apart from these, recent additions are few. The billon coins apparently are confined to the earlier years of the reign, and though the annual issue of copper continued through the upheaval caused by the invasion of Taimūr, it is strange that a gap should occur from 804 to 811 and possibly till 813, no coins with intermediate dates being on record. Maḥmūd died in 815, but coins continued to be struck in his name during the following year. Thereafter the nobles who held sway over the remnants of the Empire utilised the types issued by kings long dead until the establishment of the Saiyid dynasty, though Mubārak, the second of that line, appears to have struck no coin in his own name till 833 H.

Gold.

1. Weight 171 grs., size ·9. Mint Dehli, date 797. [H. R. Nevill.]

Obv. in circle.	Rev.
الامام	السلطان الاعظم
في زمن	ابو المظفر محمود شاه
امير المومنين	محمد شاه فيروز شاه
خلدت خلافته	سلطاني

Margin: ضربت ..... بحضرت دهلي ٧٩٧

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2. Weight 174 grs., size ·75. [I.M.C., No. 507.]

Obv.
الا مام
في زمن
المومنين
امير———ر
خلدت خلافته
٨٩٦

Rev.
السلطان الا عظم
ابو المحامد محمود شاه
محمّد شاه فيروز شاه
سلطاني

3. Weight 169, ·5 grs., size ·8. [I.M.C., No. 508.]

Obv.
الا مام
في زمن
المومنين
امير———ر
خلدت خلافته
٨٠٠

Rev.
السلطان الا عظم
ابو المظفر محمود شاه
محمّد شاه فيروز شاه
سلطاني

Silver.

4. Weight 174 grs., s. 1. [Thomas, No. 276.]

Obv.
الا مام
في زمن
المومنين
امير———ر
خلدت خلافته
٨١٤

Rev.
السلطان الا عظم
ابو المحامد محمود شاه
محمّد شاه فيروز شاه
سلطاني

5. Weight 159 grs., s. ·9. [I.M.C., No. 510.] Date 806.

Obv.
as in 4 but
٨٠٦

Rev.
السلطان الا عظم
ابوالمفظر محمود شاه
محمد شاه فيروز شاه
سلطاني

Billon.

6. Weight 140 grains. [Thomas No. 277.] Dates 795, 796.

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Obv.	Rev.
الخليفه ابو	سلطانى
عبد الله خلدت	محمد شاه
خلافته ٧٩٥	محمود شاه

7. Weight 56 grains. [Thomas, No. 279.]

Obv,	Rev.
الخليفه	سلطانى
المومنين	محمد شاه
امير——ر	محمود شاه
خلدت خلافته	

Copper.

8. Weight 140 grains, s. ·7. Dates recorded 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 813, 815.

Obv. in circle.	Rev.
شاه	المومنين
محمود	نائب امير
	٧٩٧

Margin : سلطاني ضربت بحضرت دهلي

9. Weight 70 grains, s. ·55. No date recorded. [Lahore Museum Catalogue, p. 107.]

Obv. in circle.	Rev.
شاه	المومنين
محمود	نائب امير
	.....

Margin illegible.

10. Weight 70 grains, s. ·55 ·6. Dates recorded 795, 796, 797, 798, 799, 800, 801, 803, 804, 814, 815, 816.

Obv.	Rev.
سلطانى	دارالملک
محمود شاه	دهلي
	٧٩٥

11. Weight 56·3 grains, s. ·5. [I.M.C., No. 520.]

Obv. in circle.	Rev. in circle, no date.
سلطانى	دارالملک
محمود شاه	دهلي

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12. Weight 140 grains, s. ·7. [H. R. Nevill.]

Obv. in circle
سلطان
محمد شاه
Traces of Margin.

Rev. in circle.
دارالملک
دهلي

13. Weight 63 grains, s. ·6. [I.M.C., No 521.]

Obv. in circle.
شاه
محمود

Rev.
دارالملک
دهلي

14. Weight 35 grains, s. ·43. [Thomas, No. 281.]

Obv.
شاه
محمود

Rev.
بحضرت
دهلي

15. Weight 17 grains. [J.R.A.S, 1900, p. 777.]

Obv.
شاه
محمود

Rev.
ت
بحضر
دهلي

X. Nuṣrat Shāh ibn Fatḥ Khān ibn Fīroz Shāh.

We know little of this claimant to the throne save that he was proclaimed in opposition to Maḥmud in 797, and for three years maintained his position in the city of Fīrozābād, so that for this period there were actually two rival kings in Dehli. After the invasion of Taimūr he returned, but was driven out by Iqbāl Khān on behalf of Maḥmud, and from 802 onwards nothing is known of him. Thomas illustrates a coin dated 807, which is manifestly in the name of Nuṣrat, but admits his inability to explain the date. The coin published by Rodgers [Lahore Museum Catalogue, p. 108] in the joint names of Nuṣrat and Maḥmūd and bearing the date 888 is a coin of Gujarāt. No silver coin of Nuṣrat has yet been found, and only one type of billon is known.

Gold.

1. Wt. 167 grains, s. ·78.
[Rodgers, J.A.S.B., 1894, No. 2, p. 66.]

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Obv.	Rev.
الامام	الواثق بتائيد
في زمن	الرحماني نصرت شاه
المومنين	سلطاني خلدت
اميـــــــو	ملكه
خلدت خلافته	
٨٠٠	

Billon.

2. Wt. 131·5 grains, s. ·65.
[Rodgers, J.A.S.B., 1894, No. 2, p. 65.]

Obv. in circle.	Rev. in circle.
شاه	المومنين
نصرت	نائب اميـــو
سلطانى	

Margin illegible.

Copper.

3. Wt. 134 grains, s. ·65. [I.M.C., No. 522.]

Obv.	Rev.
شاه	دارالملک
نصرت	دهلي
سلطانى	

4. Wt. 66 grains, s. ·6. Dates recorded 797, 798.

Obv.	Rev.
شاه	دارالملک
نصرت	دهلي
ـــنى	٧٩٧
سلطـا	

5. Wt. 70 grains, s. ·55. No date.

Obv.	Rev.
شاه	دارالملک
نصرت	دهلي
ـــنى	
سلطـا	

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6. Wt. 60 grains, s. ·55. [H. R. Nevill.]

Obv.	Rev.
شاه	دارالملک
نصرت	دهلی
سلطانی	

7. Wt. 65 grains, s. ·55. [H. R. Nevill.]

Obv.	Rev.
سلطانی	دار الملک
نصرت شاه	دهلی

8. Wt. 34 grains. Date 797. [J.R.A.S., 1900, p. 490.]

Obv.	Rev.
شاه	ت
نصرت	بعضر
٧٩٧	دهلي

It should be explained that in some cases the recorded weight is not exactly that of the particular specimen quoted as the original publication, but that of more perfect specimens since observed. The use of grains as the standard of weight is open to obvious objections as the weight of coins was manifestly reckoned in *ratis*. For example, many of the small billons are described habitually as 55-grain coins, whereas it is obvious that in theory, and very frequently in reality, they were coins of 56 grains or 32 *ratis*. Similarly the ordinary 140- grain coin of Fīroz Shāh and his successors was undoubtedly a coin of 80 *ratis*, and if in a few instances the actual weight exceeds this amount by a grain or two, we have to make allowances for slight inaccuracies on the part of the mint in coinage struck in the baser metals.

Simla, 1920. H. Nevill.

223. Coins of the Pathan Kings of Delhi.

The Saiyid Dynasty.

After the death of Maḥmūd in 815 H. there was no Sulṭān in Dehlī. The supreme power was vested actually, though not nominally, in Daulat Khān Lodī, but this ruler struck no coins in his own name, contenting himself with recording the current dates on coins bearing the legends adopted by Maḥmūd, Fīroz and Muḥammad. The same practice was adopted by his successors.

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I. Khiẓr Khān.

Though styled Khiẓr Shāh on the coins of his grandson Muḥammad, and in the pages of the historians, it is doubtful if this noble styled himself Sulṭan during his reign, which lasted from 817 H. to the accession of his son Mubārak in 824. Like Daulat Khān, he preserved the forms of coins issued by Fīroz Shāh, merely inscribing thereon the actual date.

The only types known are the rupees of Muḥammad dated 818, the large 140-grain billons and the 70-grain coppers, both in the name of Fīroz. Ferishta indeed states that he struck coin in the names of Taimūr and Shāhrukh, but no tangible evidence in support of this tale has been adduced, and the actual presence of coins struck at Dehlī during his rule with the name of Firoz seems to afford conclusive proof of its falsity.

II. Mu'izzu-d-dīn Mubārak.

For the first eight years of his reign Mubārak Shāh appears to have followed the practice adopted by his father, as no known piece bearing the name of the Sulṭān earlier than 732 H. has come to light. His copper is common, but his silver *tanka* is extremely rare, and no gold piece has yet been discovered. Mubārak is said by his biographer Yaḥyā bin Aḥmad to have died in Rajab 837, but his coins run on till 838. Probably those of that date are posthumous, as Muḥammad bin Farīd unquestionably issued coin in his own name with the date 837. The absence of any billon coin is remarkable.

Silver.

1. Weight 174 grains. Dates recorded 833, 834, 835, 837 [Thomas, No. 287.]

Obv.	Rev.
الامام	في عهد
في زمن	السلطان الغازي
المومنين	المتوكل على الرحمن
امير ——— ر	مبـــارکشـــاه
خلدت خلافته	السلطان
٨٣٣	

Copper.

2. Wt. 172 grs., s. ·7. Dates observed, 832, 833, 834, 835, 836, 837. [Thomas, No. 288.]

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Obv.	Rev.
Area in circle.	
شاه	المومنين
مبارک	نائب امير
	۷۳۳

Margin : سلطان ضربت بحضرت دهلي

The weight of this coin is remarkable, as it clearly indicates a piece of 100 *ratis* or a true copper *jaitil*, and is a fresh appearance of a copper coin which is not a mere token. As already noted, coins of over 165 grains were struck by Abūbakr, clearly with the same intent.

3. Wt. 84 grs., s. ·6. Dates observed, 832, 833, 834, 835, 836, 837, 838, 854, 855. [Thomas, No. 289.]

Obv.	Rev.
مبارکشاه	دارالملک
سلطان	دهلي
	۸۳۳

The posthumous coins of 854 and 855, first observed by Rodgers, were clearly issued by Bahlol Lodī after the flight of 'Ālam Shāh from Dehlī, before his outward and visible assumption of sovereignty.

4. Wt. 42 grs., s. ·45. [Thomas, No. 290.]

Obv.	Rev.
شاه	بحضرت
مبارک	دهلي

III. Muḥammad Shāh bin Farīd.

The successor of Mubārak reverted to the normal forms of coins issued by the later rulers of the Tughlaq dynasty. It seems clear that the reign of Muḥammad continued till 849, as coins of that date are known, whereas none issued by his successor has been found bearing an earlier date than 950.[1] The silver coins of this Sulṭān are very rare.

Gold.

1. Wt. 175 grs., s. ·75. Dates observed 841, 843, 844, 845. [Thomas, No. 291.]

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[1] V. Thomas, p. 36, Note.

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Obv.	Rev.
الامام	السلطان الاعظم
في زمن	ابو المحامد محمد شاه
المومنين	بن فريد شاه شاه
امير ——— ر	بن خضر
خلدت خلافته	
٨٤١	

Silver.

2. Wt. 175 grs., s. ·3. Dates observed 844, 846.
[Thomas, No. 292.]

Obv.	Rev.
الامام	السلطان الاعظم
في زمن	ابوالمحامد محمد شاه
المومنين	بن فريد شاه شاه
امـ ——— ير	بن خضر
خلدت خلافته	سلطاني
٨٤٦	

Billon.

3. Wt. 140 grs., s. ·65. Mint Dehlī. Dates observed 841, 842, 843, 844, 845, 846, 847, 848, 849. [Thomas, No. 292.]

Obv.	Rev.
الخليفه امير	سلطان
المومنين خلدت	محمد شاه
خلافته ٨٤١	فـ ——— ريد شاه
	خضر شاه دهلي
	بحضرت

4. Wt. 55 grs., s. ·5. No date.
[Lahore Mus. Cat., p. 109.]

Obv.	Rev.
الخليفه	سلطان
المومنين	محمد شاه
اميـ —— ر	فريد شاه
خلدت خلافته	بحضرت دهلي

Copper.

5. Wt. 140 grs., s. 7. Dates observed 840, 844, 846.
[Thos., No. 294.]

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Obv.	Rev.
In circle.	
شاه	المومنين
محمد	نائب امير
	۸۴۴

Margin : سلطان عربت بحضرت دهلي

6. Wt. 87 grs., s. 55. Dates observed 837, 838, 839, 841, 842, 843, 844, 845, 846, 847, 848, 849. [Thomas, No. 295.]

Obv.	Rev.
محمد شاه	دارالملک
سلطانی	دهلي
	۸۴۴

NOTE.—In the coins of 837 to 841 we find سلطان

7. Wt. 35 grs. [Thomas, No. 296.]

Obv.	Rev.
شاه	بحضرت
محمد	دهلي

I confess that though Thomas gives this coin I am unable to distinguish it from the similar coin of Muḥammad bin Fīroz. There may be a difference, but I am unaware of its nature.

IV. 'Alāu-d-dīn 'Alam Shah.

The reign of 'Ālam is shrouded in some obscurity. He seems to have resided in Dehlī from 849 to 853, then to have moved his capital to Budaun, and to have abdicated in 854, although Bahlol Lodī did not formally assume the crown till 855. Thereafter he lived at Budaun in obscurity till his death in 883.

No gold coin of this ruler has yet been found and only one silver piece has come to light.

Silver.

1. Wt. 175 grs., s. 8. [J.A.S.B. Numismatic Supplement, No. XXVI, p. 483.]

Obv.	Rev.
الامام	سلطان
في زمن	عالمشاه بن
المومنين	علا لدنيا و الدين
امير	محمد شاه بن شاه
خلدت خلافته	فريد
۸۵۲	

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The date is but partially visible, and the reading is uncertain.

Billon.

2. Wt. 140 grs., s. ·65. Dates observed 851, 852, 853, 854. [Thomas, No. 297.]

Obv.	Rev.
الخليفه امير	سلطان
المومنين خلدت	عالمشاه
خلافته ٨٥٢	بـــــن
	محمد شاه
	بحضرت دهلي

3. Wt. 55 grs., s. ·55. [Thomas, No. 298.]

Obv.	Rev.
الخليفه	سلطان
المومنين	عالمشاه
اميـــــر	بن محمد شاه
خلدت خلافته	بحضرت دهلي

Thomas gives a variety of this coin with ضربت دهلی This is improbable, but possibly the reading given by Rodgers explains the matter, as he considers that the word ضربت occupies the extreme right of the last line.

Copper.

4. Wt. 140 grs., s. 7. Dates observed 852, 853, 854. [Thomas, No. 300.]

Obv.	Rev.
عالمشاه	المومنين
	نائب امير
	٨٥٢

Margin : سلطان ضربت بحضرت دهلي

5. Wt. 77 grs., s. ·6. Dates observed 850, 851, 852, 853, 854.

Obv.	Rev.
عالمشاه	دارالملک
سلطان	دهلي
	٨٥٢

No small coppers are known. Thomas No. 302 is obviously not a distinct type, but comes under coin No. 3.

H. Nevill.

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224. Coins of the Pathan Kings of Dehli.

The Lodī Sulṭāns.

1. Bahlol Lodi, 855–894 H.

Although Bahlol obtained possession of Dehlī in 854 H. after the departure of 'Alāu-d-dīn 'Ālam, he did not strike coin in his own name but apparently utilised the dies of Mubārak Shāh, if any inference can be drawn from the existence of copper coins bearing the name of that ruler and the dates 854 and 855. The earliest known piece of Bahlol, struck in his own name, is dated 855.

The coins of the Lodīs are relatively uninteresting. It may be too much to say that they issued no coin in gold or silver, but at any rate pieces in these metals have yet to be discovered.

Billon.

1. Wt. 144·5 grs. (average) s. ·8. Dates observed, 856–866, 873–894. [Thomas, No. 311.]

Obv.	Rev.
في زمن	المتوكل على
المومنين	الرحمن بهلول
اميـــــــر	شاه سلطان
خلدت خلافته	بحضرت دهلي
٨٥٧	

The gap of six years in the issue of these coins is remarkable. It is most improbable that no coins were struck during this period, but it is odd that none should have been recorded. Possibly the coins of intervening years are known to private collectors.

2. Wt. 130 grs., s. ·7. [Rodgers. J.A.S.B., 1880, No. 2, p. 83.]

Obv.	Rev.
الخليفه	بهلول شاه
المومنين	سلطان
اميـــــــر	بحضرت دهلي
خلدت خلافته	

3. Wt. 56 grs. s. ·55. [Thomas, No. 312.]

Obv.	Rev.
as in 2.	as in 2.

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4. Wt. 56 grs., s. ·57. [Rodgers, Lahore Mus. Cat., p. 112.]

Obv.	Rev.
الخليفه	المتوكل على
المومنين	الرحمن بهلول
امير——ر	شاه سلطان
خلدت خلافته	.....

5. Wt. 56 grs., s. ·6. Date 857 [Rodgers, Lahore Mus. Cat , p. 113.]

Obv.	Rev.
الخليفه	سكه
المومنين	بهلول شاه
امير——ر	سلطان
خلدت خلافته	
٨٥٧	

Copper.

6. Wt. 140 grs., s. ·7. Dates observed, 867–879, 882, 887, 888, 889, 892. [Thomas, No 315.]

Obv.	Rev.
In circle.	المومنين
بهلول	نائب امير
شاه	٨٦٨

Margin : سلطان ضربت بحضرت دهلي

7. Wt 84 grs., s. ·61. Dates observed : 855–877, 882, 887, 888. [Thomas, No. 313.]

Obv.	Rev.
بهلول شاه	دارالملك
سلطان	دهلي
	٨٥٥

8. Wt., 67 grs. Dates observed : 868, 886, 889, 893, 894· [Thomas, No. 314.]

Obv.	Rev.
الخليفه	بهلول شاه
المومنين	سلطان
امير——ر	
خلدت خلافته	
٨٨٦	

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9. Wt. (average) 37 grs., s. ·55.
[Rodgers, Lahore Mus. Cat., p. 113.]

Obv.	Rev.
بهلول شاه	بحضرت
سلطان	دهلي

10. Wt. 38 grs., s. ·4. [Rodgers, Lahore Mus. Cat., p. 113.]

Obv.	Rev.
شاه ل	الخليفه
بهلو	المومنين
سلطان	اميـــــر

11. Wt. 65 grs., s. 6. Mint Jaunpur. Dates recorded 898–894. [B.M.C., No. 493.]

Obv.	Rev.
بهلول شاه	شهـــر
سلطان	جونپور
	٨٨٨

II. Sikandar bin Bahlol Lodi, 894–923 *H.*

While Bahlol Lodi followed the example of the Saiyid Sulṭāns, at any rate as regards the issue of billon and copper types, the known coins of his successor are limited to the standard billon of some 80 *ratis* and its subdivisions.

In this restricted field there are but two points of interest. The first of these relates to the difference between the coins of Dehlī and Āgra. The earlier type of large billon struck at Hazrat Dehlī closely resembles in its general appearance that of Bahlol. whereas the later type is very distinctive with its angular script and much more deeply incised die. The earliest specimen of this latter type that I have seen is dated 901. For some years the two run on concurrently, and the latest of the Dehlī type known is of 909, long after the formal transfer of the capital to Āgra.

The second point is the absence of any coins later than 920. This is remarkable, for Sikandar struck billons by the million and his coins of every previous year are abundant. I can offer no reason for the rarity, if not the complete disappearance, of coins issued after 920. Possibly it is connected with a change of currency, for the 140-grain billon of Ibrāhim is unknown, but this is mere guesswork, and the matter is one which demands further elucidation.

Billon.

1. Wt. 140–145 grs. s. ·65. Dates observed, 894–909 H.
[Thomas, No. 316.]

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Obv.	Rev.
في زمن	المتوكل على
المومنين	الرحمن بن
امیـــــر	سكندر شاه
خلدت خلافته	بهلول شاه
۸۹۴	سلطان دهلي
	بحضرت

2. Wt. 140–145 grs. s. ·7. Dates observed, 901–920 H.

Obv.	Rev.
في زمن	المتوكل على
المومنين	الرحمن بن
امـــــير	سكندر شاه
خلدت خلافته	بهلول شاه
۹۰۲	سلطان

These coins were, it is suggested, struck at Āgra.

3. Wt. 56 grs. s. ·55. Dates observed 897–911.

[Thomas, No. 317.]

Obv.	Rev.
في زمن	المتوكل على
المومنين	الرحمن بن
امیـــر	سكندر شاه
خلدت خلافته	بهلول شاه
۸۹۷	سلطان

4. Wt. 35 grs. s. ·42. [I.M.C., No. 106.]

Obv.	Rev.
Portions of above.	Portions of above.

No date in this size is recorded.

5. Wt. 17·5 grs. s. ·35. [I.M.C. No. 608.]

Obv.	Rev.
part of	.....
سكندر شاه	خلافته
بهلول	۸۹۸

III. Ibrāhīm bin Sikandar Lodi, 923–932 *H.*

The coinage of Ibrāhīm is even less interesting than that of his father. There are no large billons, and with few excep-

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tions the coins contain a mere fragment of the legend. The execution is degenerate and the dates are seldom legible. Those recorded are confined to a very few years of his reign. The only copper issue is that of the Mālwa type illustrated by Thomas, the specimen quoted being, it is believed, still the only one found.

Billon.

1. Wt. (highest known) 88·5 grs. s. 6. Dates observed 923, 925, 926, 927. [Thomas, No. 318.]

Obv.	Rev.
في زمن	المتوكل على
المومنين	الرحمن ابراهيم شاه
اميـــــر	سكندر شاه
خلدت خلافته	سلطان
٩٢٦	

2. Wt. 42 grs. s. 45. Dates observed 925, 926, 927, 928. [Thomas, No. 820.]

Obv.	Rev.
Portions of above.	Portions of above.

Copper.

3. Wt. 110 grs. Square. [Thomas, No. 321.]

Obv.	Rev.
ابراهيم شاه لودے	السلطان
بن سكندر	ـــــــن
	السلطان

This is in imitation of the ordinary Mālwa copper, and is supposed to commemorate the capture of Chanderī by Ibrāhīm. Unfortunately the date is missing.

IV. Maḥmūd bin Sikandar Lodī.

After the disastrous battle of Pānīpat in 932 the Afghān forces were wholly disorganised, and the remnant fled eastwards into Bihār. Their leader was Maḥmūd, a younger brother of Ibrāhīm, and practically all we know of this Sulṭān is that he was proclaimed king in Bihār in 935. His reign was brief, for Bābar was then on his heels, and the Sulṭān, who at first had been a mere refugee and had been put on the Eastern throne after the disappearance of Jalalu-d-din Lohānī, again fled eastwards, to take refuge with the ruler of Bengal.

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Billon.

1. Wt. 140 grs. s. ·7 [H. R. Nevill.]

Obv.	Rev.
في زمن	سلطان
المومنين	بن محمود
اميـــــر	سكندر شاه
خلدت خلافته	سلطان

٩٣٥

This coin lay unnoticed, save for its unusual date, among the coins of Sikandar, which it closely resembles. The reading is unmistakable, but its similarity to those of Sikandar may well have caused others to overlook similar specimens.

H. Nevill.

Simla, 1920.

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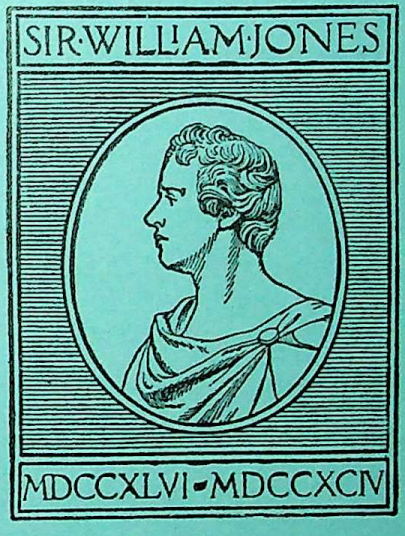

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4. Timur's Apocryphal Memoirs.

By H. Beveridge

Timur was long treated as if he were another Prester John. People knowing little or nothing about him, but eager to give news, invented all sorts of stories and palmed them off on the public. One of the first romancers was a Messire Jean du Bec, an Abbé of Mortemere. His book was published at Rouen in 1594. It was followed by a book of a similar character written or professing to be written, by a certain Sieur de Saynleon whose book was published at Paris in 1677. Both these writers asserted that they had travelled in the East or at least in the Levant; and both, apparently, claimed to have got their information from a book written by a learned astronomer named Alhacan or Alhusain. Apparently, the Frenchmen gave this name to their source because there was a celebrated Arab astronomer and philosopher of this name who was a native of Bussorah and who died at Cairo in 1038. See the Nouvelle Biographie Universelle II, 86. Jean du Bec professed to have had possession of Alhacan's book, but did not pretend to have been able to read it. He said it has been interpreted to him by an Arab who could speak Italian. His words as translated into English are "Tamarlane had a companion and familiar of his conquests, named Alhacan, an Arabian by birth. He was a great and worthy person learned as well in natural philosophy, as in astrology. This author then having fallen into my hands, on my voyage into the East country, I caused the same to be interpreted unto me by an Arabian who did speak Franck (Frankish) (as they term it) that is to say Italian." Jean then goes on to speak of his wounds. Similiarly the Sieur de Saynleon based his narrative on Alhacan. But his book seems to have had little success: Probably, it appeared too late, for it was not published till 1677. Jean du Bec's work, however, had a great success. There was an early translation into English by some one who only gives the initials H. M. and was published in London in 1597. There was a reprint of it by Strahan in 1750. It also appeared before this in Purchas's Pilgrims and occupies 68 pages of Vol. XI of the Hakluyt Society's reprint. It was surely a waste of time and money to republish such a useless book which tells of Timur 'being the son of Og, and of the name Tamarlane' signifying the Grace of God! It is small blame to Purchas that he printed the rubbish, but the recent editors might have done better.

As J. Golius says with justice in his Latin preface to

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Arab Shah's work on Timur, such writers (meaning Jean du Bec and others) are mere *umbrae* or ghosts, except possibly where they treat of Timur's expeditions into Asia Minor. "Quae ad nos. de illa (re, Timur's career) hactenus pervenere, vix umbrae haberi possunt aut vix aliud quam somnia et commenta dabant, nisi pauca forsan ad quae in Europae confiniis gesta sunt."

I ought to say here that I am indebted to Sir F. Goldsmid's article on Timur in the Encyclopaedia Brittanica for introducing me to a knowledge of Jean du Bec's book. But I can hardly say that Sir Frederick's article is a good one. He was a good man and an excellent public servant, but he should have left Timur alone. He gives a wrong title to Arab Shah's work, confounding it with Qazwīnī's work on the marvels of creation and says, Arab Shah was translated by Golins. This is a mistake; what Golins did was to edit the Arabic text. The translations are by Vattier and S. H. Manger; the latter being in Latin and published at Leovardia(?) in 1767. There is a much better account of Timur in D'Herbelot though he made a mistake about Arab Shah's not mentioning the iron cage. It is noteworthy that Jean du Bec mentions that Bajazet was kept in an iron cage, a fact which tallies with Golius' conjecture that Jean du Bec is less untrustworthy as regards Western Asia.

The next attempt to write a fictitious account of Timur was made by a Persian, a native of Turbat in Khurasan who was called Abu Tālib Alhusaini. This last title resembles the Alhacan or Alhasan of Jean du Bec, and there is a suspicious likeness between the stories of the two Frenchmen and of Abu Talib as to the provenance of their originals. But there is no evidence that they borrowed from one another.

The first notice that we have of Abu Talib's book is dated 1636 or 37 when he presented Timur's Memoirs to Shah Jahan in India. His story was that he had found the Turkish text of Timur's Memoirs in Arabia in the library of Jaffar Pasha when he [Abu Tālib) was residing in Mecca and Medina. His editor Afzal Bokhari, improved on this story by saying that the manuscript was found in Yemen which of course is a long way to the south of the two holy cities. And Mr. Erskine and Professor Dowson have thought that Abu Tālib and Afzal Bokhari's accounts are corroborated by the fact that a Jaffar Pasha was Governor of Yemen in 1610. But if he was there in 1610 it is almost certain that he was not there more than twenty years afterwards. No Turkish or Turkī, Memoirs have ever been found and Abu Tālib has not a word to say as to what became of them or whether he brought the original or a copy to India. He never says that he showed either original or copy to Shah Jahan. And it shows the uncritical spirit of one of the writers (Major Davy) in the White

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and Davy edition of the Memoirs that he actually puts forward the admitted mystery of the finding and disappearance of the Turkish manuscripts as perhaps the strongest possible proof of the genuineness of Abu Tālib's find! See extract from letter, p. x of Major Stewart's preface to the Malfūzāt. A much stronger evidence against the genuineness of the manuscript is to be found in the way that Shah Jahan at first treated Abu Tālib's communication.

Instead of reverencing it as the composition of his great ancestor, he makes it over to another man to correct and to bring it into harmony with Sharafu-d-dīn's Ẓafarnāma. That is to say, to bring it into accord with the work of a man who had apparently never seen Timur and was the contemporary not of Timur but of his grandson Ibrahim and who did not write his history till twenty years after Timur's death! And the corrector Afzal Bokhari, a well-known officer of Shah Jahan's Court altered Abu Tālib's version accordingly, striking out what he thought wrong, adding where there were omissions and correcting the dates. It is true that Shah Jahan afterwards, wanting to give good advice to his son Aurangzeb when he was in charge of the Deccan from 1636—44 sent him an extract from Abu Tālib's work about the duties of a governor. This appears in Vol. I, Part II, p. 289, of the Bib. Ind. edition of the Bādshāhnāma. And what rubbish this supposed advice of Timur's is! It is thoroughly unpractical and reminds us of Bentley's description of the once famed letters of Phalaris, as the work of a pedant dreaming at his desk, and not of a great prince with his hand upon his sword (we quote from memory). The extract consists of an inappropriate quotation from Sa'di to the effect that strength and wisdom are of no avail if not in accordance with God or destiny. See Graf's edition of the Bostān, p. 287. And this is followed by a number of common-places which could be of no help to a young governor.

The instructions alleged to have been sent by Timur and sent by Shah Jahan for the edification of Aurangzeb do not appear in the Ẓafarnama of Sharafu-d-dīn, but appear in Abu Tālib's manuscript Or 158 of the B M., and in Afzal Bokhari's amended edition, B.M.M.S Add. 16,186 p. 208^b. They profess to have been issued by Timur in 794 A.H. (1391-2) to his grandson Pir Muhammad s. Jehāngīr when he was appointed to the charge of Kabul, Kandahar, and of India as far as the Indus. The Ẓafarnāma I, 558, Bib. Ind. edition, gives the appointment of Pir Muhammad and the names of the officers who were to assist him but as stated above does not give the instructions. The quotation from the Bostan appears also both in Or. 158 and in Add. 1686.

Though I regard Abu Tālib's work as a forgery it is quite possible that he may have had access to some records of Timur's

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sayings and doings. His book is certainly not entirely a reproduction of Sharafu-d-dīn since in one place he makes a reference to Nizāmu-d-din Shāmī's Ẓafarnāma, for in the account of the taking of Baghdad he refers to the fact of Niẓāmu-d-dīn having been the first person who came from the city and did obeisance to Timur This is not mentioned by Sharafu-d-din but occurs at p. 99^{b} of Niẓāmu-d-din as quoted by Rieu. This was in 795 A.H. and the reference to Or. 158 is at p. 258. Abu Tālib makes Timur say to Niẓām-u-din that God was good to him in making him the first man to submit! I confess it is not quite clear to me that Shah Jahan was not in collusion with Abu Tālib if indeed the latter person be not altogether mythical. In spite of Shah Jahan's apparently contemptuous treatment of Abu Tālib in the first instance, he afterwards saw the advantage of such a panegyric on his ancestor. Other Timurides acted in the same way and had Abu Tālib's book sumptuously bound and adorned with pictures and red seals.

And what Timurid and what Indian Muhammadan would not act in the same way? They would all feel bound to support the glory of the House of Timur. I therefore would pay little attention to the opinion of Muhammadans about the authenticity of the Memoirs. Far more value is to be attached to the opinions of disinterested scholars such as Sachau and Ricu. Sunnīs, we are told, even assert that Timur was an orthodox Sunnī Muhammadan, though he really was a Shia.

In conclusion I would point out that there seems to be several differences in the manuscripts of Sharafu-d-dīn's Ẓafarnāma. The Bib. Ind. edition, for example says nothing about the labours of Ibrahim in collecting information and Petit de la Croix's translation seems to show that there was a similar hiatus in the manuscripts used by him.

4th August, 1920.

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5. The Genus *Cerebella* in India.

By L. S. Subramaniam, *Assistant to the Imperial Mycologist, Agricultural Research Institute, Pusa.*

[With Plate I].

Cerebella is one of the little known genera of the family Hyphomycetae-Tuberculariae. It is commonly found associated with species of *Sphacelia* on many members of the Gramineae. In Bombay and Madras one species is common on cultivated Jowar (*Sorghum vulgare*) producing black swellings on the grains Only three species have been so far recorded in the East, *viz.*, *C. inquinans* (B. et Br.) Petch, *C. Anthistiriae* Petch and *C. Ischaemi* Petch.

Recently a species of *Cerebella* on *Sorghum vulgare* was received for identification from the Philippine Islands. In connection with this, the material in the Pusa Herbarium was critically examined by the writer and it was found that the Indian material contained many new species. The present paper gives the determination of all the species of *Cerebella* known at present in India.

My thanks are due to Mr. J. H. Walton, M.A., M.Sc., Offg. Imperial Agricultural Bacteriologist, for the micro-photographs.

Cerebella burmanensis, n. sp.

Investing the ovaries, stroma naked, flattened, gyrosoplicate, scattered, 1½-3 mm.. long, black, compact or powdery. Glomerules, globose or subglobose, blackish brown, composed of 2 to 10 cells, 15-29·7μ in diameter and not breaking into component cells. Individual cells angular or subglobose, 7-11μ in diameter, epispore rough and warty. Pedicels coloured deep yellow.

On ovaries of *Panicum setigerum.*

Mandalay, Burma, 17-1-19. Coll. F. J. F. Shaw.

Cerebella Andropogonis-contorti, n. sp.

Investing the ovaries, stroma naked, elongated, gyrosoplicate 2 to 5 mm. long, scattered or effused, black, often covering the whole spikelet. Glomerules, compact, subglobose or ovoid, deep blackish brown, composed of 2 to 7 cells, 13–33 in diameter. Individual cells, subglobose or polyhedral, 9–13μ in diameter, epispore rough. Pedicels hyaline or slightly tinged yellow.

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On ovaries of *Andropogon contortus*.

Maymyo, Burma, 18-1-08. Coll. E. J. Butler.
Dumraon, Bihar, 20-11-03. Coll. E. J. Butler.

Cerebella Nardi, Butl., n. sp.

Investing the inner glumes, stroma covered, black, gyrosoplicate, 1-3 mm. long. Glomerules, subglobose or cylindrical, composed of 2 to 8 cells, deep brown and measure 16·5-20·1μ in diameter. Individual cells, angular or subglobose, greyish brown, epispore smooth, and measure 8-11μ in diameter. Pedicels deeply coloured brown.

On glumes of *Andropogon Nardus*.

Mundanthorai, Tinnevelly, Madras, 11-5-1901. Coll. C. A. Barber.

This name was given by Dr. E. J. Butler, but it was not published.

Cerebella Sorghi-vulgaris, n. sp.

Investing the ovaries, stroma naked, hemispherical, gyrosoplicate, 2 to 5 mm. long, scattered, black or olive grey, powdery. Glomerules, subglobose or irregular, composed of 2 to 7 cells and measure 10·2–33μ in diameter. Individual cells subglobose or angular, 6·6–13·2μ in diameter, greyish black, epispore slightly rough or pitted. Pedicels coloured brown.

On ovaries of *Sorghum vulgare*.

Rishivandayam, Madras, Coll. C. A. Barber; Poona, Bombay, December 1916, Coll. S. L. Ajrekar; Los Banos, Philippine Islands, 6-1-20, Coll. O. Reinking.

Cerebella cenchroidis, n. sp.

Investing the ovaries, stroma, gyrosoplicate naked or covered, greyish black, sometimes attacking the rachis, 1-2 mm. long. Glomerules angular, subglobose or ovoid, light brown, composed of 2 to 5 cells and measure 14·3-17·6 × 9·9 - 15·4μ in diameter. Individual cells irregular or subglobose and measure 4·4 - 14·3μ in diameter, epispore smooth. Pedicels coloured greyish black.

On ovaries of *Pennisetum cenchroides*.

Lahore, 26-9-17. Coll. G. S. Cheema.

On ovaries of *Cenchrus biflorus*.

Lahore, 26-9-17. Coll. G. S. Cheema.

Cerebella antidotale, n. sp.

Investing the ovaries, stroma, gyrosoplicate, naked, oval or flattened, covering the grains, 1-3 mm. long, black. Glom-

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erules, spherical or polyhedral, dark olive, composed of 2 to 6 cells, epispore rough and measure 15-22 × 10-17*u* in diameter. Individual cells greyish black, epispore rough, 8-12*u* in diameter. Pedicels coloured, smoky yellow. Spore surface rough.

On ovaries of *Panicum antidotale.*

Sangla Hill, Punjab, 28-10-07. Coll. G. S. Cheema.

Cerebella Cynodontis, Syd.

On ovaries of *Cynodon Dactylon.*

Lakoalli, Mysore, 17-9-03. Coll. E. J Butler.
Bilikere, Mysore, 19-9-03. Coll. C. A. Barber.
Hunsur, S. Mysore, 21-9-03. Coll. E. J. Butler.
Sylhet, Assam, 19-5-05. Coll. E J. Butler.

On *Panicum prostratum.*

Seeraha, Champaran, Bihar, 31-10-03. Coll. E. J. Butler ; Pusa, 21-20-06, Coll. E. J. Butler.

On *Panicum distachyum.*

Bassein, Burma, 30-11-12. Coll. E. J. Butler.

Slightly different from the type in the major number of spores being smooth.

Cerebella inquinans (B. et Br.), Petch.

= Thecaphora inquinans, B.et Br.
= Cerebella Paspali, Cke. et Mass.

On *Paspalum scrobiculatum,*

Bassein, Burma, 30-11-12. Coll. E. J. Butler.

,, *P. longiflorum.*

Sylhet, Assam, 29-5-05. ,, ,, ,,

,, *P. Royleanum.*

Ranchi, Orissa, 30-9-17. ,, ,, ,,

,, *P. sanguinale* var. *ciliaris.*

Dacca, 10-11-18. Coll. P. C. Kar.

, *Panicum javanicum.*

Ranchi, Orissa. 30-9-17. Coll. E. J. Butler.

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DESCRIPTION OF THE PHOTOGRAPH.

Fig. 1. *Cerebella burmanensis.*
,, 2. ,, *Andropogonis-contorti.*
,, 3. ,, *Nardi.*
,, 4. ,, *Sorghi-vulgaris.*
,, 5. ,, *Cenchroidis.*
,, 6. ,, *antidotale.*
,, 7. ,, *Cynodontis.*
,, 8. ,, *inquinans.*

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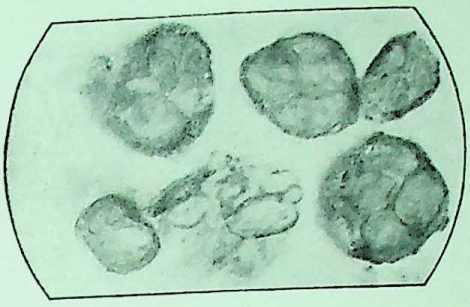

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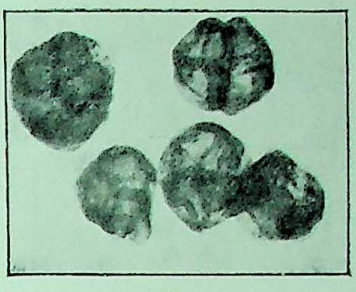

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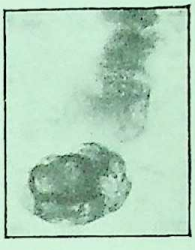

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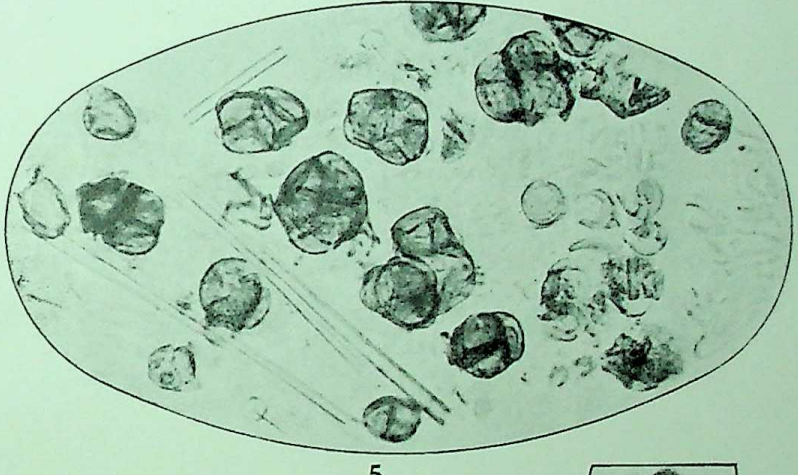

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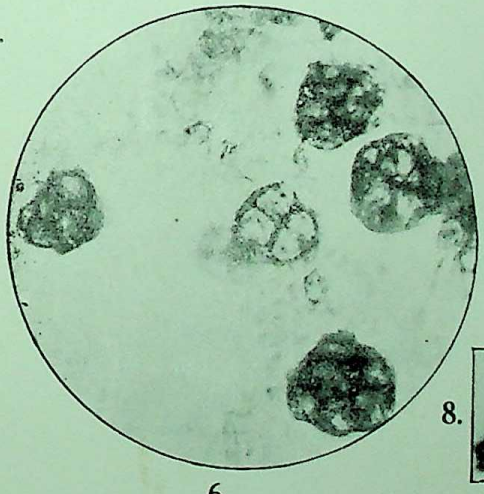

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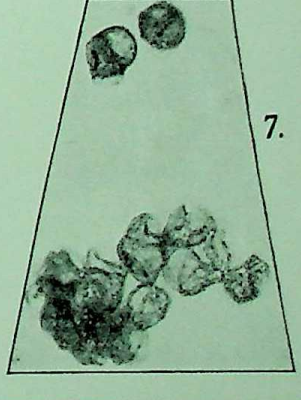

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6. On the Discovery of the Neolithic Indian Script.

By Hem Chandra Das-Gupta, M.A., F.G.S.

Among the recent contributions that have been made to our knowledge of prehistoric India are to be included two extremely interesting papers by Mr. Yazdani[1] and by Prof. Mitra.[2] On account of the far-reaching nature of these discoveries, all students of prehistoric antiquities in India are naturally tempted to study the matter critically and the present note embodies the result of such a critical study.

My remarks will be confined to Prof. Mitra's discovery for a general account of which we are also indebted to Prof. Bhandarkar.[3] According to Prof. Mitra there exist in the collections of the Indian Museum five neolithic artifacts with signs and of these two have been deciphered as giving readings which convey some sense while the other three have only got a mark on each and evidently no clue has been found to read them.

The method adopted to find out the age of the scripts being in the main one followed by students of palaeontology, it is necessary in the first place to enquire into the conditions under which the neoliths in question were obtained, because unless it can be proved that they were found buried in some natural deposits any attempt to correlate the time of the inscription of the marks found on the stones with the time when the stones themselves were fashioned into their present shape and form must be open to serious objection. As far as my knowledge of Indian prehistoric stone implements goes, there are only a very few cases where they have been found in natural deposits; the vast majority of them have been found lying scattered on hill-tops or level surfaces and, chiefly on account of this, it is not possible to establish with precision in India the different substages into which the prehistoric time may be divided and I think that in any attempt that is made towards a systematic study of the Indian prehistoric antiquities attention should be paid to this fundamental difference between the modes of occurrence of the prehistoric stone implements in Europe and in India.

The two neoliths with decipherable scripts have been found in (1) Chota-Nagpur and (2) Assam. The Chota-Nagpur implement was obtained at Ranchi and it was among the

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[1] Journ. Hyderabad Arch. Soc. pp. 56-79, 1917.
[2] Ind. Antiq. May, 1919, pp. 57-64.
[3] Cal. Rev. Jan. 1920, pp. 21 39.

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collections from an old neolithic settlement[1]. There is nothing to show that the piece of hematite was obtained from any natural deposit or that even any excavation had to be made for obtaining it. According to Mr. Driver who collected the specimens most of them, including the one under question, were found in different parts of the fields and tradition has it that they were made and worn by a mythological people called the Assurs[2] There is even at present a small tribe, called the Asurs, the peculiarities of whom have been described by Driver.[3] These persons are now found in the north-west of the district of Ranchi and they live chiefly by iron-smelting.[4] According to some ethnologists these Asurs may be connected with the mythological Assurs for a detailed account of the remains of whom we are indebted to Mr. Roy.[5] Belwadag is one of the villages mentioned by him and by digging up the ruins of this village, the same area, locally called 'Ita-danr' (brick-field), was found to yield not only stone implements and copper ornaments, but also a gold coin which is 'a Kushana coin of the Huvishka type.'[6] From the above statements it is quite clear that the implement in question was not found in a natural deposit and accordingly the marks on it can never be used for homotaxial purpose. Coins of the Kushana type were found associated with similar neoliths and from this assemblage it may also be concluded that the implement was fashioned and the marks cut on it during the time when the Kushana coin was in use or that the implement was manufactured previously but the marks were inscribed at a later date when the Kushana coin was in use or marks on the implement were intermediate in age between the manufacture of the implement and the manufacture of the gold coin. The figure of a man with a stone implement, as found at Amaravati,[7] shows clearly that at least in parts of the Madras Presidency the stone age must have persisted almost to the beginning of the Christian era while 'we have in the Juangs representatives of the stone age *in situ*'[8] and according to Ball so far as the Khariahs are concerned, previous to the incoming of the Hindus, their axes and their implements for grubbing up roots, were in all probability made of stone, and their arrows had tips made of the same material.[9]

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[1] Journ. Asia. Soc. Beng. Vol. 57, pt. ii, p. 337, 1888.
[2] Proc. Asia. Soc. Beng. p. 222, 1887.
[3] Journ. Asia. Soc. Beng. Vol. 57, pt. i, pp. 7-18, 1888.
[4] Dist. Gazet., p. 80.
[5] Journ. Beh. Oris. res. Soc. Vol. I, pp. 229-253, 1915.
[6] Op. cit., p. 232.
[7] Fergusson: Tree and serpent worship in India, p. 144, pl. 32.
[8] Dalton: Descriptive ethnology of Bengal, p. 153, 1872.
[9] Proc. Asia. Soc. Beng., p. 193, 1868.

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From the observations made above it follows that if the implement, in question, with the marks on it were found buried in some natural deposit and if immediately on recovering it from its bed the presence of the marks was detected, there would have been a reasonable presumption in support of the conclusion that the marks did really represent some inscriptions that were produced during the neolithic time, provided the depth of the deposit and its state of induration supported the idea, though whether the marks are really alphabets or not should be decided by palaeographers and philologists. Prof. Bhandarkar read the scripts as forming the word 'Maata' meaning a headman or chieftain.[1] He assumed that at the time when these incisions were made the Brahmi script used to be written from right to left. I must confess that I know nothing about the form of the Brahmi script during the different periods of its growth, but there is a volume of opinion against the theory that the Brahmi script was ever written from right to left and for a short account of the whole question reference may be made to the very interesting summary given by Pandit G. H. Ojha.[2] This palaeographical controversy is, however, of no interest to us from our present point of view as whether the earliest form of the Brahmi script was from right to left or from left to right and whether the marks on the implement No. 3177 are alphabets or not, there is no evidence to show that they were actually inscribed during the neolithic time. The fifth neolith mentioned by Prof. Mitra, with a mark on it, was also obtained from the same locality and I have no additional remark to offer regarding it.

I shall now discuss the evidence that is afforded by the second neolith with decipherable script and obtained from Assam. This implement was mislaid at the time Dr. Brown prepared his catalogue and though Prof. Mitra has given us a description of the celt, he has not mentioned the particular place in Assam from which it was obtained. The implement in question bears the catalogue number 998. The specimens with numbers 996 and 997 were both obtained from Shillong. This fact, coupled with Mr. Cockburn's description

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[1] Speaking about the word 'Maata' Prof. Mitra observes that "it survives to-day curiously enough, such is the degradation of words brought about probably by social circumstances, in the lowest degraded class in India, the cleaners of refuse—the 'mehtar' and the 'mehtua' .... The very depth of the social scale to which these people have sunk, shows the vast lapse of ages which must have gone by since the time these very people were actually princes and chieftains" (loc. cit., p. 63), It may be observed, however, that even at the present day, the chief of Chitral is called a 'mehtar or 'mihtar.'

[2] Ojha: The palaeography of India, p. 27.

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of the Khasi hill stone implements,[1] leaves no room to doubt that this is his specimen B of which a figure has also been published by him. Mr. Cockburn had no definite idea about its place of occurrence beyond the fact that it was found on the Shillong plateau evidently not buried in any natural deposit. Accordingly it is quite clear from what has been said above, that there is nothing to show definitely that the marks on the implement were inscribed during the neolithic time. In the figure of the implement published by Mr. Cockburn the marks referred to by Prof. Mitra are also shown very clearly, but there are two rows of marks and not one, the upper row being rather indistinct. It is extremely difficult to pass any remark on the third specimen referred to by Prof. Mitra. It bears the catalogue number 866, but a reference to Dr. Brown's catalogue[2] shows that there are two specimens bearing the number 866, the locality of one being unknown and unfortunately Prof. Mitra has not indicated which one of the two he has in view.

Of the five neoliths mentioned by Prof. Mitra, I have already dealt with four and there is only one left. This was obtained from Bellary by the late Mr. Foote. There is nothing on record to show the mode of occurrence of the celt, but a perusal of Mr Foote's description about the mode of occurrence of the Bellary implements[3] makes it quite clear that it was obtained either from an old neolithic settlement or from the surface, but certainly not from any natural deposit. This mode of occurrence as also the fact that only a single mark has been found make the implement quite valueless as giving us any evidence proving the existence of a neolithic script in India.

Thus it appears that judging the question from the point of view of the occurrence of the implements the existence of a neolithic script in India has not been established and more conclusive evidences are necessary to prove the case.

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[1] Journ. Asia. Soc. Beng. Vol. 58, pt. ii, pp. 133-137, 1879.

[2] Brown: Catalogue raisonné of the prehistoric antiquities in the Indian Museum, p. 131.

[3] Foote: Indian prehistoric and protohistoric antiquities. Notes on their ages and distribution, pp 78 et seq.

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7. Recent Advances in Stereochemistry.

By Prof. B. K. Singh, M.A.

[Read at the Nagpur Indian Science Congress.]

The subject of my address to-day is stereochemistry in some of its modern developments. There are several reasons which have induced me to make this selection. One is that I have been especially interested in this branch of chemistry during the past few years; another which is even more important, is that the subject is receiving increasing amount of attention from chemists at the present time. The subject of optical activity has furnished several important discoveries which have materially contributed towards the development of modern chemistry. The progress of chemistry has been mainly achieved as a result of the co-ordination of observed facts with a series of hypotheses, each closely related in point of time to the one preceding it. The atomic theory of Dalton, enunciated in 1803, and the hypothesis of Avogadro formulated in 1813, were two great theoretical developments which gave great impetus to chemical investigation, and led to the association of a definite physical meaning with the idea of molecular composition. These however, ultimately proved insufficient for the interpretation of a large number of facts collected under their impetus. A further great advance was only made possible when Kekule in 1858, introduced into chemistry his doctrine of valency and the law of the linking of atoms. The conception of molecular constitution followed as a necessary corollary of this new doctrine, and led to clearer ideas about the constitution of chemical compounds by means of their graphic formulæ. Once more the theoretical scheme proved insufficient to embrace all the known facts, until in 1874, Van't Hoff and LeBel independently demonstrated the all-important part which molecular configuration plays in the interpretation of certain cases of isomerism in organic chemistry. In 1815, Biot observed that certain liquid organic substances deflect rays of plane polarised light, either to the right or to the left. The consequences of this discovery have been far reaching. The conception of molecular asymmetry introduced by Pasteur half a century later, the arrangement of atoms in space conceived by Wislicenus and formulated by Van't Hoff and LeBel, and the more recent advances in the correlation of optical activity with chemical constitution can all be said to have emerged from the capital discovery of the French physicist. This property is of more than ordinary importance; it concerns

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even life itself, as the complex molecules met within living material are optically active. In this way, stereochemistry has intruded itself into other sciences, e.g. Biochemistry.

For a quarter of a century after the enunciation of the doctrine of the asymmetric carbon atom by Van't Hoff and LeBel in 1874, no instance was known of an optically active substance which did not contain an asymmetric Carbon atom. The discovery by Pope and Peachey in 1899 of d-and l-benzylphenylallylmethylammonium iodides, $(C_6H_5)(C_7H_7)(C_3H_5)(CH_3)$ N1, however, furnished compounds in which the optical activity was due to no other element than an asymmetric quinquevalent Nitrogen atom. Similar instances were later added by the resolution of other types of nitrogen compounds of enantiomorphous molecular configuration by Meisenheimer and the present writer.

The resolution of quaternary ammonium salts was rapidly followed by the preparation of optically active substances in which the enantiomorphism is associated with the presence of an asymmetric sulphur, selenium, tin, phosphorus, or silicon atom. In all the above cases it is possible to single out one particular quadrivalent or quinquevalent atom which is separately attached to four or five different atoms or radicles; in other words the enantiomorphism of molecular configuration may be detected by the presence of such an asymmetric atom.

In 1874 Van't Hoff had already predicted that molecular enantiomorphism and optical activity should be realizable by the allene type of molecule :

$$\begin{matrix} a \\ b \end{matrix} \rangle C:C:C \langle \begin{matrix} c \\ d \end{matrix}$$

in which there is no individual asymmetric atom present. Previously this case had escaped realisation experimentally, but in 1909, Perkin, Pope and Wallach furnished an example fulfilling similar conditions by resolving 1-methylcyclohexylidene-4-acetic acid

$$\begin{matrix} CH_3 \\ H \end{matrix} \rangle C \begin{matrix} CH_2 - CH_2 \\ CH_2 - CH_2 \end{matrix} \rangle C:C \langle \begin{matrix} H \\ COOH \end{matrix}$$

into its optically active components. This substance although necessarily possessing enantiomorphous molecular configuration contains no atom which is asymmetric in the sense of the original definition. The optically active complex cobalt, chromium, rhodium and iron compounds obtained by Werner

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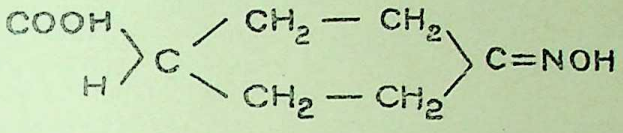
in recent years must also be regarded as instances of molecular asymmetry.

Another instance of molecular asymmetry is furnished by 4-oximino-cyclohexane-carboxylic acid :



which was resolved into the d-and l-forms in 1910 by Miss Bain, now of Delhi, working under Mr. Mills at Cambridge. This discovery is of more than ordinary importance, as it also furnished a proof for the validity of the views of Hantzsch and Werner on the isomerism of oximes.

A problem of long standing was at last solved in 1914, when Pope and Read succeeded in obtaining chloroiodomethanesulphonic-acid, CH Cl I. SO_3 H, in the d-and l-forms. This substance contains only one atom of carbon, and possesses the simplest possible constitution (except one radical). It is remarkable as its optical activity is very persistent, and it does not undergo racemisation. Hitherto it had been customary to regard that a certain degree of molecular complexity was necessary before a substance of enantiomorphous molecular complexity could exhibit optical activity. This feeling found support from the fact that no optically active compound was known which contained fewer than 3 carbon atoms in the molecule, and that no resolution of the salts of mixed tertiary amines has yet been effected.

Relation between Optical activity and Chemical constitution.

The next subject which is receiving great attention from chemists at the present time is the correlation of optical activity and chemical constitution. We have as yet no clear idea why substances of enantiomorphous molecular configuration exhibit optical activity, but lack of knowledge on this point has not deterred the chemist from pursuing this study, which has resulted in the accumulation of large masses of quantitative data about optical activity. The complete correlation of these results must, however, await till we get from the Mathematical physicist a theory of optical activity comparable in quantitative completeness to the electromagnetic theory of light.

(*a*) Optical activity in homologous series :

Numerous attempts have been made to discover a connection between optical activity and chemical constitution of a compound since Crum Brown and Guye independently in 1890

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brought forward the theory connecting mass and molecular rotatory power. This now discarded theory gave rise to a large amount of experimental work, the results of which up to 1904, have been summarised by Walden and since then up to 1912 by Frankland In the light of more recent work this failure is of little significance as most of the work above referred to was carried on a class of compounds known as *esters* which are particularly prone to exhibit anomalous rotatory dispersion. Ethyltartrate has been fractionated into portions which differ very widely in their rotatory power for violet light, although the differences are small when green or yellow light is used. The substituted quaternary ammonium and azonium compounds as well as the secondary carbinols recently prepared by Pickard and Kenyon are more suitable for testing this theory. These compounds possess the simplest possible chemical constitution and contain only one asymmetric carbon or nitrogen atom having all the radicles attached directly to it. The result of this work also is not favourable to the theory, but certain regularities in a qualitative sense can still be traced in it. Thus representing the compounds by the symbols Cabcd and N (abcd) X, the effect of increasing the size of *d* the "growing chain," on the rotatory power depends on the size of (or the space occupied by) the other radicles *a*, *b* and *c* in the molecule. If the space occupied by *a*, *b* and c, is very small, the effect of increasing the size of *d*, on the rotatory power depends on its configuration. In the " methyl" series of carbinols, CH_3 CH (OH) R, the space occupied by *a*, *b* and *c* is the smallest conceivable (CH_3, H, OH) and the values of the molecular rotatory powers of individual members in solution (ethyl alcohol and benzene) are considerably exalted when the whole molecule itself approximates to a ring structure, as in methylpropylcarbinol, and methyloctylcarbinol, or when the growing chain in a similar manner all but returns on itself as in methylamylcarbinol and methyldecylcarbinol :

Normal Secondary Alcohols of the formula $CH_3CH(OH)R$.

R. (A normal Alkyl group.)	$(M)_d$ Ethyl Alcohol.	$(M)_d$ Benzene.	$(M)_{d^{20°}}$ (homogeneous state.)	$(M)_{d^{b.p.}}$ (homogeneous state.)
Ethyl ..	10·77°	....	10·3°	6·3°
n-propyl ..	*13·60*	*15·73*	12·1	10·6
n-Butyl ..	12·95	14·23	11·8	11·3
n-amyl ..	*13·28*	15·90	12·0	11·4
n-hexyl ..	12·73	16·77	12·7	11·7
n-heptyl ..	13·10	16·98	12·9	12·1
n-octyl ..	*14·04*	*18·10*	13·7	12·5
n-nonyl ..	13·95	17·69	14·0	12·7
n-decyl ..	*14 76*	*18·57*	14·5	13·2
n-undecyl ..	14·74	17·48	14·4	13·7

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On the other hand, the molecular rotatory power in the homogeneous state increases regularly by small increments as the chain grows.

When, however, the space occupied by the groups a, b and c is larger, the increase in molecular rotatory power as d increases, becomes less regular. In the "Ethyl" series, $C_2 H_5$ CH (OH) R, there are sudden increments when the "growing" chain contains 5, 10 and 15 carbon atoms.

Normal Secondary Alcohols of the formula $C_2 H_5$ CH (OH) R.

R. (A normal alkyl group.)	Homogeneous state. $(M)_D$	Ethyl Alcohol. $(M)_D$	Benzene. $(M)_D$
Methyl ..	11·9°	10·77°	10·44°
Propyl ..	2·29	1·17	1·87
Butyl ..	11·11	11·17	10·80
Amyl ..	*12·53*	*14·47*	13·26
Hexyl ..	12·43	13·86	*13·82*
Heptyl ..	12 26	9·81	12·11
Octyl ..	12·43	10·69	12·18
Nonyl ..	12·86	11·35	12·48
Decyl ..	*14 42*	*13·46*	14·62
Undecyl ..	14·55	13·38	*15·60*
Dodecyl ..	14·59	12·44	15·32
Tridecyl ..	14·32	12·75	15·44
Tetradecyl ..		Has not been prepared.	
Pentadecyl ..	14·83	12·91	16·63

Besides, the sudden increments which occur when the growing chain contains 5 or a multiple of 5 carbon atoms, there is a gradual, though slow increment in the rotatory power throughout the series.

If the space occupied by the groups a, b and c is still greater, the "approximate maximum" is reached when the growing chain contains fewer than five carbon atoms. Thus in the "isopropyl" series of carbinols $(CH_3)_2$ CH. CH (OH)R where the isopropyl group $(CH_3)_2$ CH—is fairly large, the member containing four atoms in the "growing chain" has the conspicuous value for the molecular rotatory power, in the homogeneous state, whereas in ethyl alcoholic solution it is the member containing five atoms in the growing chain which has the conspicuous value.

Carbinols, $(CH_3)_2$ CH. CH (OH). R.

R. (A normal alkyl group.)	Homogeneous state. $(M)_D^{20°}$	$(M)_D^{b.p.}$	Alcoholic solution. $(M)_D^{20°}$
Methyl ..	+ 4·3°	+ 3·7°	+ 4·7°
Ethyl ..	15·4	12·4	16·73
n-Propyl ..	24·7	21·9	27·97
n-Butyl ..	*33·3*	*29·1*	35·97
n-Amyl ..	32·9	28·7	*38·24*
n-Hexyl ..	33·9	29·2	38·36
n-Octyl ..	34·5	29·0	39·99
n-Decyl ..	34·5	29·0	39·38

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In the case of the substituted quaternary ammonium and azonium series, where the groups *a*, *b* and *c* are very large, the "approximate maximum" is reached, when the growing chain contains three carbon atoms as in Phenylmethylbenzylammonium series:

$(C_6H_5)\ (CH_3)\ (C_7H_7).\ \overset{|}{N}—R.$

R. (alkyl group)	$(M)_d$ for the ion in aqueous solution.
Ethyl ..	64°
n-Propyl ..	*299*
iso-Propyl ..	*398*
n-Butyl ..	253
iso-Butyl ..	323
iso-Amyl ..	287

This series also brings out the constitutive effect of the alkyl groups on the rotatory power.

The same is the case with Phenylmethylallylammonium series

$(C_6H_5)\ (CH_3)\ (C_3H_5)\ \overset{|}{N}—R.$

R. (alkyl group)	$(M)_d$ for the ion in aqueous solution.
Ethyl ..	16°
n-Propyl ..	*106*
iso-Propyl ..	103
iso-Butyl ..	55
iso-Amyl ..	18

In the case of Phenylbenzylazonium series investigated by the writer, the molecular rotatory power increases rapidly with the length of the "growing chain." The "approximate maximum" in this case cannot be determined as the series is not yet complete but from analogy it may be predicted that this maximum will be reached when the growing chain contains 3 or 4 carbon atoms:

$(C_6H_5)\ (C_7H_7)\ (NH_2)\ N—R.$

R. (alkyl group)	$(M)_d$ for the ion in aqueous solution.
Methyl ..	*117°*
Ethyl	..
(Allyl) ..	137·1
n-Propyl ..	247·5

(*b*) The Effect of Conjugated Unsaturation:

Rupe as the result of his earlier observations (Annalen 1903, *327*, 157) laid down the general rule that unsaturated groups usually produce an enhanced rotation, which falls off with the increased distance of the unsaturated group from the active radical. This early view was revised by him later on as the result of some further work (Trans. Faraday Society, 1914, *10*, 5), and he is now of opinion that unsaturation leads to irregularity in the rotatory effect, though not neces-

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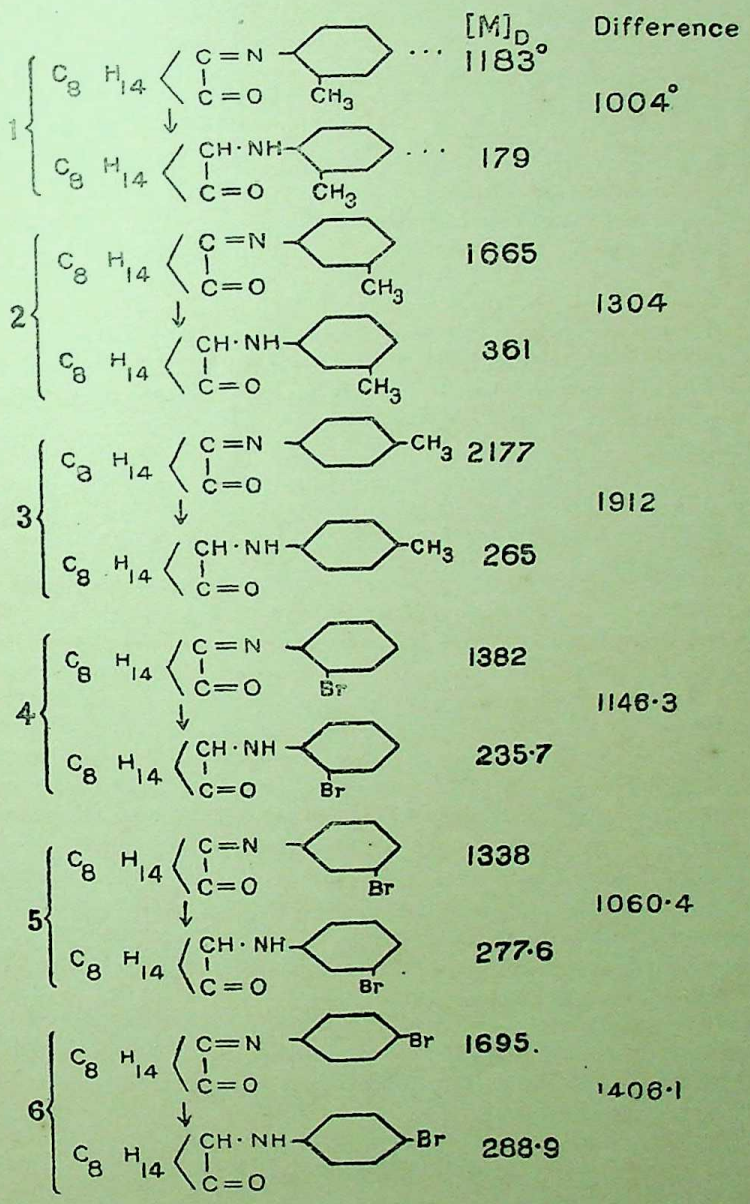
sarily to an increased rotation. The great effect of Thiele's conjugated double bonds on rotation which was discovered in 1903 from experiments on the Menthyl esters of Sorbic acid, $CH_3.CH:CH.CH:CH.CO_2R$, (Rupe, Annalen, 1903, *327*, 167) is convincingly shown by recent work. Some interesting results on this relation, which have been obtained by the writer in the case of derivatives of imino and amino-camphor are shown in the following Table:—



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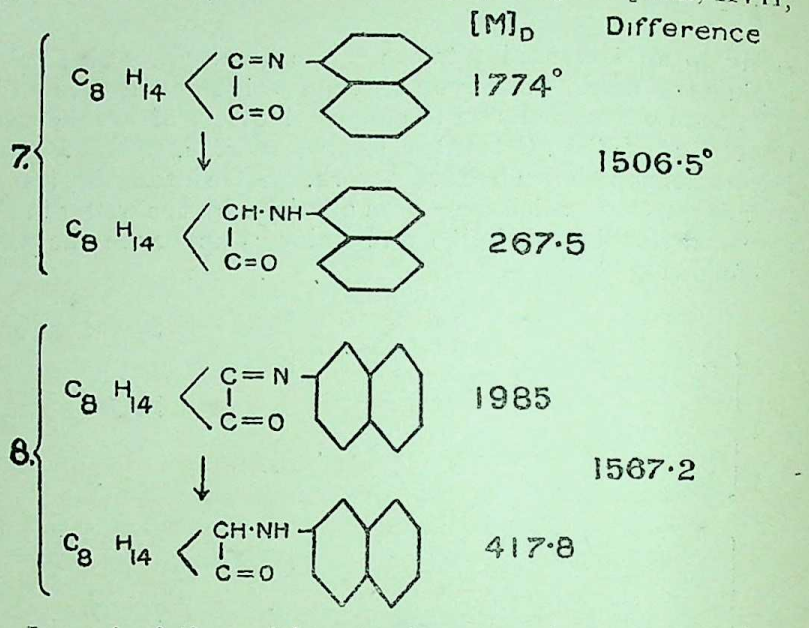
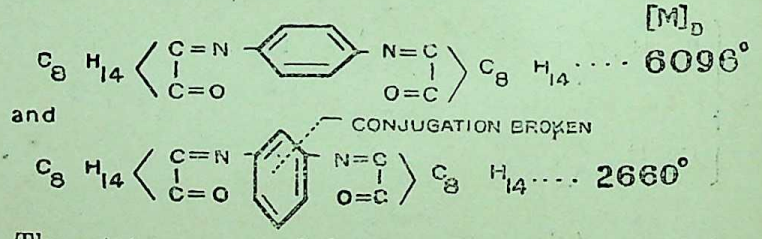


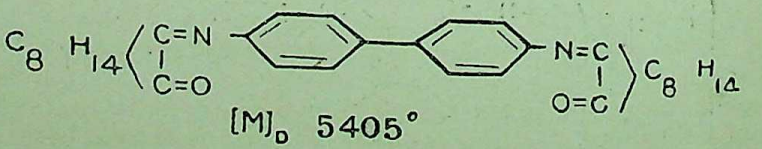
In each of these eight sets of compounds the only change effected has been the addition of two atoms of hydrogen in the imino-derivative thereby breaking the conjugation. The fall in rotatory power when conjugation is broken is simply phenomenal

The effect of complete conjugation between carbon, oxygen, and nitrogen atoms with the benzene ring on rotation is brought out very clearly in the meta and para phenylene-bisiminocamphors :



The rotatory power of the p-compound is more than twice as large as that of the meta, and this is obviously due to uninterrupted chain of conjugations in the molecule of p-phenylenebisiminocamphor, which, however, does not exist in the meta derivative.

Again p-phenylenebisiminocamphor



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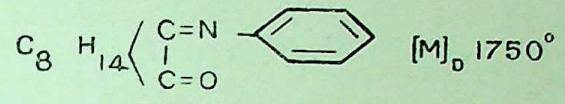
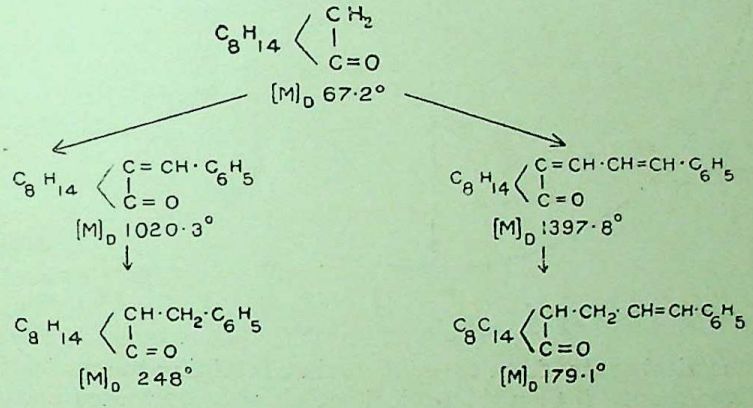
has more than three times as high a rotation as phenyliminocamphor:



Judging from the molecular formulæ of the two compounds, and allowing for the two phenyliminocamphor residues in the former compound, the difference in rotatory power of 1905° (5405–2 × 1750) must be ascribed to the length of the conjugated chain, which is twice as long in the former compound as in the latter.

Hilditch (T. 1909, *95*, 333) has also obtained compounds with high rotation constants by condensing camphor with aldehydes. The effect of breaking the conjugation in this series is also phenomenal:



(*c*) The Effect of Position-Isomerism on Optical Activity.

The relation between chemical constitution and rotatory power which is investigated most is that of position isomerism in the aromatic groups present in optically active compounds. Frankland in 1896, as the result of his observations on the rotatory powers of dibenzoyl and ditoluoyl tartrates, found that the order of rotation in the case of position isomerides was ortho < unsubstituted nucleus < meta < para. Taking the analogy of a weight acting at the end of a lever arm he explained the above changes in rotatory power produced by nuclear substitution in the ortho, meta and para positions in a side chain containing an optically active group in the following way:—

The centre of gravity of the unsubstituted nucleus being at the centre of a regular hexagon that in the ortho derivative

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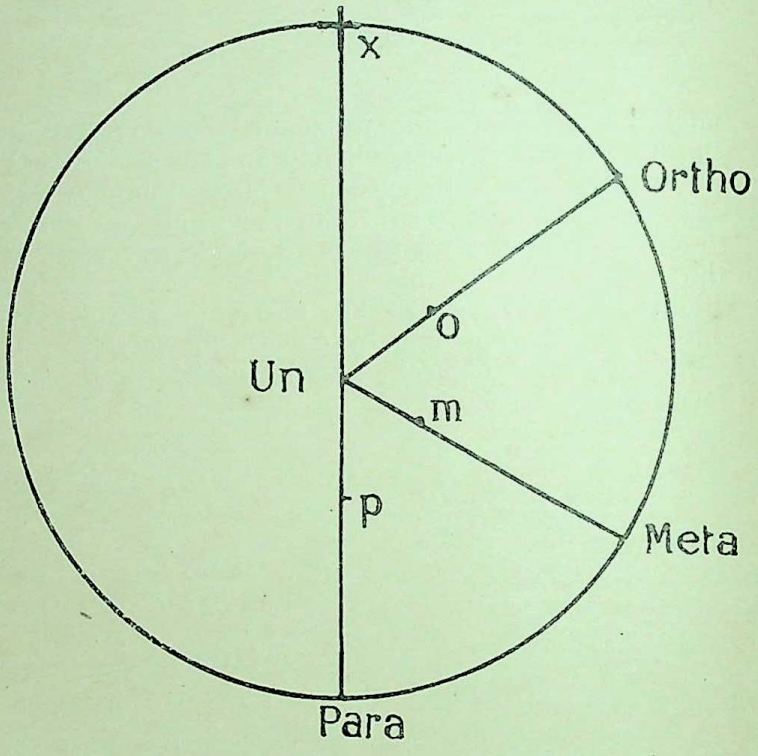
would be somewhat nearer, in the meta derivative somewhat further, and in the para derivative still further than that



geometrical centre from the side chain containing the optically active group. If then the optical activity is determined by the moment of the mass of the group, the rotatory power of the para isomeride should be the greatest, that of the ortho the least and that of the meta derivative intermediate between those of the other two. In the case of the unsubstituted nucleus, the mass is smaller, but it acts through a longer arm than in the case of the larger mass of the ortho compound, but through a shorter arm than in either the meta or para compound.

Frankland revived this Theory in 1912 in his Presidential address before the Chemical Society and sought to illustrate its validity by a few selected observations of Cohen and his collaborators :

Position Isomerism and Optical Activity (Cohen and Dudley, Trans. 1910, 97, 1737).

		$(M)\alpha^{20°}$	$(M)\alpha^{100°}$
Menthyl benzoate	.. ..	−.239·0°	−232·7°
,, o-toluate	.. ..	231·1	223·1

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	$(M)_d^{20°}$	$(M)_d^{100°}$
Menthyl m-toluate	240·0	234·7
,, p-toluate	246·4	237·2
,, o-methoxybenzoate	148·2	154·7
←——————→	←——→	←——→
,, m-methoxybenzoate ..	247·6	242·7
,, p-methoxybenzoate ..	250·7	238·6
,, o-ethoxybenzoate ..	....	157·3
←——————→	←——→	←——→
,, m-ethoxybenzoate ..	244·0°	237·4°
,, p-ethoxybenzoate ..	....	238 3
,, o-propoxybenzoate ..	170·4	180·1
←——————→	←——→	←——→
,, m-propoxybenzoate ..	240·6	235·1
,, p-propoxybenzoate ..	250·1	234·0
,, o-isopropoxybenzoate ..	168·8	175·7
←——————→	←——→	←——→
,, p-isopropoxybenzoate ..	246·1	233·3
,, o-isoamyloxybenzoate ..	186·8	196·2
←——————→	←——→	←——→
,, m-isoamyloxybenzoate ..	240·6	237·6
,, p-isoamyloxybenzoate ..	247·6	233·8
,, o-allyloxybenzoate ..	....	174·9
←——————→	←——→	←——→
,, p-allyloxybenzoate ..	251·8	236·9
,, o-benzyloxybenzoate ..	172·3	162·8
←——————→	←——→	←——→
,, p-benzyloxybenzoate ..	255·1	238·9
,, o-dimethylaminobenzoate ..	....	100·9
←——————→		←——→
,, p-dimethylaminobenzoate ..	....	257·9

(*N.B.*—The arrow ←·——→ is placed in the position which the benzoate should occupy according to Frankland's rule, and the arrow ←——→ in the position which experimentally it is found to occupy.)

Thus not once in these nine cases is Frankland's rule violated at the lower temperature, whilst at the higher temperature the para is slightly out of order with regard to the meta on several occasions.

He, however, omits from this address, other observations of Cohen which do not support his rule :

Menthyl esters of benzoic acid.	Menthylbenzoate $(M)_d^{20°}-239°$. Fl	Cl	Br	I	NO_2
o	− 194·5°	− 195°	− 205°	− 237°	− 381°
m	236	237	239	237	251
p	239	237	239	237	237·5

o<m<B=p; o<m=p<B; o<m=B=p; o=m=p<B; p<B<m<o.

Menthyl esters of benzoic acid.	Menthylbenzoate $(M)_d^{100}$ −233°. Fl	I	NO_2
o	− 188·5°	− 236°	− 370°
m	− 229	− 233·5°	− 250
p	− 239	− 224	− 230

o<m<B<p; p<B<m<o; p<B<m<o

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It is seen that the ortho compound produces the largest deviation from the constant of the unsubstituted compound, and not once in these 8 cases is Frankland's rule borne out by these results. Cohen as a result of these discrepancies lays down another rule which is to the effect that the rotatory power produced by an ortho substituent differs more from that of the unsubstituted compound than do those of the meta or para derivatives.

The writer has investigated several series of new compounds derived from Camphorquinone and finds that both these rules are invalid. The molecular rotatory powers of derivatives of phenyliminocamphor are given in the following table :—

Derivatives of phenylimino-camphor.	$(M)_d$ Chloroform solution phenylimino camphor=1750°.			
	CH_3	Br	Cl	OCH_3
ortho	1183°	1382°	441·7°	612°
meta	1665	1338	1338	..
para	2177	1695	1768	3314

o<m<un<p ; m<o<p<un ; o<m<un<p ; o<un<p.

Derivatives of phenylamino-camphor.	$(M)_d$ Methyl alcohol solution phenyl-aminocamphor=1462°.		
	CH_3	Br	Cl
ortho	1030°	1311°	486·4°
meta	1504	1260	1261
para	2001	1545	.. ..

o<un<m<p ; m<o<un<p ; o<m<un.

If the theory of Frankland were correct, i.e. the rotatory power were determined by the position of the centre of gravity of the nucleus in relation to the optically active group, we should expect :

(i) the greater the mass of the substituting element or group, the greater would be the difference between the constants of the para and ortho isomerides; and

(ii) the para-isomeride would have the maximum rotation and ortho the least.

It is seen that the order laid down by Frankland is followed only once in the case of tolyl compounds in methyl alcoholic solution, out of the seven cases above investigated. Secondly, in the case of bromphenyl derivatives, it is the meta compound and *not* the *ortho* which has the lowest rotation. Thirdly, the difference in rotatory powers of ortho and para tolyl derivatives is 3 to 4 times as large as in the bromphenyl derivatives, although Bromine is a much heavier element than the methyl

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group. Fourthly, the nature of the *solvent* is sufficient to bring about an alteration in the order of rotatory power, as is seen in the case of tolyl and bromphenyl derivatives in chloroform and methyl alcohol solutions.

Cohen's Rule is also not obeyed as it is the meta compound in the case of bromphenyliminocamphor and the para derivative in the case of methoxyphenyliminocamphor which differ most in rotatory power from the constants of the unsubstituted compound and not the ortho.

The results obtained by the writer in the case of derivatives of phenylaminocamphor equally go against the above rules as the following points show :—

	$(M)_d$ Chloroform solution phenylaminocamphor=309°.	
Derivatives of phenylaminocamphor.	CH_3	Br
ortho	179°	235°
meta	361	277·6
para	265	288·9
	o < p < un < m ;	o < m < p < un.

	$(M)_d$ Methyl alcohol solution phenylaminocamphor=229·81.	
Derivatives of phenylaminocamphor.	CH_3	Br
ortho	174°	230·2°
meta	198	207·9
para	158	209·6
	p < o < m < un ;	m < p < un < o.

(i) The order of rotatory powers as laid down by Frankland is not followed once in the above four cases.

(ii) The difference in rotatory powers of *o*—and *p*—tolyl compound is $1\frac{1}{3}$ times as large as that in the case of Bromphenyl derivatives in chlorofrom solution, although Bromine is a heavier group than the methyl radical.

(iii) In no case has the para compound the maximum rotation; whereas the ortho, meta, and the unsubstituted compound each has had the maximum rotatory power.

(iv) The effect of solvent on the order of rotatory power of position isomerides is remarkable; the *ortho* bromphenyl compound has the lowest value in chloroform, whereas it has the highest value in methyl alcohol.

(v) Cohen's Rule is followed in chloroform solution, but not in methyl alcohol.

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It has thus become clear that we have as yet no rule which can apply to all the cases hitherto investigated and the most important point which has emerged from this work is that the nature of the solvent plays a considerable part on the order of rotation of position isomerides. The conclusion is naturally forced on us that this problem is much more complicated than was anticipated by Frankland and others.

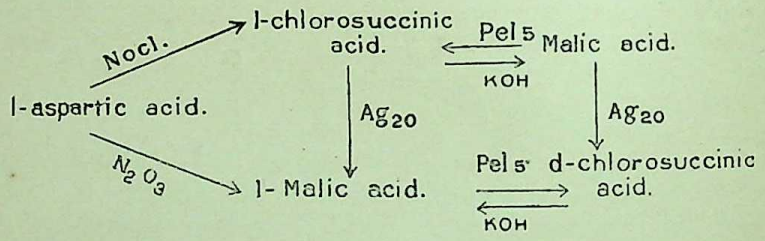
The effect of position isomerism on optical rotatory power in the case of the naphthalene nucleus has also been studied by the writer. It is found that the substituent in the β-position has somewhat higher rotatory effect than in the α-position.

		$(M)_d$ chloroform.	$(M)_d$ Methyl alcohol.
Naphthyliminocamphor	α	1774°	1625°
	β	1985	1893
Naphthylaminocamphor	α	267·5	210
	β	417·8	366·2

But experience already gained from similar work warrants the supposition that it is possible that this relation may not hold in all cases.

THE WALDEN INVERSION:

I wish now to draw your attention briefly to a remarkable Inversion, first described by Walden in 1896, as shown in the following scheme:—



You will observe that not only laevorotatory but also dextro-rotatory, chlorosuccinic acid can thus be obtained from one and the same laevorotatory aspartic acid, according as the amino-group is replaced by chlorine by means of nitrosyl chloride, or is first replaced by hydroxy group by means of nitrous acid, the hydroxyl being subsequently replaced by chlorine with the aid of phosphorus pentachloride. Further laevorotatory or dextrorotatory chlorosuccinic acid can be converted each into its enantiomeride on replacing the chlorine through the agency of silver oxide, and then re-introducing the chlorine in place of the hydroxyl group by means of phosphorus pentachloride. An optical cycle of changes is thus accomplished, during which a change of configuration occurs, though it is not clear at which stage of reaction, this

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change of configuration is brought about. Now it does not follow that a change of sign of rotation represents an abnormal reaction (i.e. a reaction in which a change of configuration takes place), for there are numerous cases where such a change occurs without assuming change of configuration. For example, the introduction of acyl groups into malic and tartaric esters produces derivatives of opposite rotation from those of the unsubstituted esters.

Since as we have seen it is the *reagent* which brings about a normal or abnormal reaction by replacement several chemists have attempted to offer explanations of the Walden Inversion in terms of the mechanism of substitution in asymmetric molecules Some of them, especially Armstrong, Gadamar and Fischer, make the supposition that during the reaction unstable intermediate compounds must necessarily be formed, in order to preserve a continuous asymmetry of the molecule, while substitution takes place; and Fischer points out that substituents such as NH_2, OH, Cl, etc., with which the Walden Inversion ordinarily occurs, are those which possess "residual affinity." This enables them to form intermediate compounds which are later decomposed and the place vacated by the old substituent is occupied by the new one (in which case no change of configuration occurs) or by one of the three already present.

Werner supposes that the nature of the groups already present has a guiding influence, by which the entering group may be attracted to one of the three faces of the tetrahedron (formed by the central carbon atom and the four associated groups) contiguous to the group X to be displaced, in which case no inversion occurs, or the entering group may be attracted to the face remote from X, in which case inversion will occur. The mechanism as proposed by Werner does not involve any reference to the fact that one group would take the place formerly held by the other.

The most recent investigations of Debye on the molecular structure of the Graphite crystal, made by means of X-rays, throw some new light also on the problem under consideration. Debye showed that under certain conditions the carbon atom can act with three valencies of equal strength, while the fourth valency is considerably reduced in comparison with the others, acting in a direction perpendicular to the plane of the last and with only a slight intensity. It is supposed that during the chemical process, a passing detachment of the radical takes place, and as soon as the new substituent arrives, the restitution of this fourth reduced valency into the original state of four equal valencies can occur towards one or towards the other side of the plane of the other three, both these events leading to two enantiomorphous configurations. But it still remains unexplained why such a change of place does not always lead

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to complete racemisation, as both antipodes have the same mechanical stability.

However, all these suggestions must be considered hypotheses, which are sometimes useful, but none the less quite arbitrary.

Frankland expressed the position quite rightly in 1913, when he stated "it appears that there does not exist at the present time any criterion by which the relation between the configuration of an optically active compound and that of its derivative can be decisively ascertained"

The most recent researches carried out by Senter and his collaborators from 1915 onwards further show the utter inadequacy of these so-called "explanations." which are based solely on the rôle which the *reagent* plays in these reactions. The phenomenon is much more complicated than was thought at first.

The rôle which the solvent plays on the sign of rotation of an optically active product first discovered in 1915 by Senter and Drew opened up a new chapter in the study of the "Walden Inversion." They showed that when the halogen atom in optically active phenylchloracetic acid is displaced by the amino group by the direct action of ammonia, the sign of the amino acid depends on the nature of the solvent in which the reaction occurs. In water, the higher aliphatic alcohols, and benzo-nitrile the resulting amino acid has the opposite sign to the chloroacid taken, whereas in liquid ammonia, acetonitrile, and the lower aliphatic alcohols, the amino acid has the same sign as the original chloroacid. These results are given in the following table :—

Senter and Drew T. 1916, *109*, 1092.

Solvent.	Sign of chloro-acid taken.	Specific rotation of amino acid formed.	Comparison of sign of product and chloro-acid.
Liquid NH_3 ..	l—	−20°−90°	Same sign.
Water	l—	+83	Change of sign.
CH_3OH	d—	d (very small)	Same sign.
C_2H_5OH ..	d—	+24	,,
C_3H_7OH (n) ..	d—	+8	,,
C_3H_7OH (iso) ..	d—	+4	,,
C_4H_9OH (n) ..	l—	+3 ?	Change of sign.
$C_7H_{15}OH$ (n) ..	d—	−73	,,
$C_6H_5CH_2OH$ ..	l—	+2	,,
$C_6H_5CH_2CH_2OH$ ..	d—	−16	,,
CH_3CN	d—	+6	Same sign.
C_6H_5CN	d—	−4	Change of sign.

In a subsequent investigation carried out in 1918, with phenylbromacetic acid, Senter and Tucker obtained results which in many respects correspond with those found for the chloro-acid. But there are also important differences which will undoubtedly prove of great value in elucidating the

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mechanism of these reactions. The main results are given in the following table which shows that in all the solvents except liquid ammonia and acetonitrile, the sign of the amino acid formed is opposite to that of the bromoacid taken.

Action of Ammonia on l-phenylbromacetic Acid.

T. 1918, *113*, 140.

Solvent.	Value of $[\alpha]$ 5461 for amino acid formed.
Liquid NH_3	−38°
Water	+89
CH_3OH	+2
C_2H_5OH	+2
C_3H_7OH (n)	+5·5
C_3H_7OH (iso)	+3·2
C_4H_9OH (n)	+17·7
$(CH_3)_3C\,OH$	+22
$C_7H_{15}OH$ (n)	+130
CH_3CN	−48·3

The chief resemblances in the two reactions discussed above are that in both cases the amino acids obtained from water and the higher alcohols as solvents are opposite in sign, those from liquid ammonia and acetonitrile similar in sign to the original phenylhalogen acid. The main difference is that with the lower aliphate alcohols the amino acid from phenylbromacetic acid is opposite in sign, from phenylchloracetic acid similar in sign, to the original phenylhalogen acid, as shown in the subjoined table :—

Solvent (alcohol).	Methyl.	Ethyl.	Propyl.	Isopropyl.
Amino acid from l-bromo acid.	+2°	+2°	+5·5°	+3·2°
Amino acid from d-chloroacid.	+7·5	+34	+10	+5

It is thus obvious that Walden's discovery is a puzzle and surprise, for it cannot fit into any pre-existing theory of optical activity and it could not have been anticipated as a corollary to Van't Hoff's theorem of the asymmetric carbon atom. It is almost certain that a complete solution of this problem will furnish us with the mechanism of the process of substitution in chemical reactions.

I have tried to place before you a brief account of some of the recent work on optical activity, but till a complete theory of optical activity is forthcoming, the correlation of these results cannot be satisfactorily accomplished. Meanwhile the duty of the chemist is to accumulate as much experimental data under as varied conditions as possible.

Addendum, 15*th July*, 1921.

Prof. J. B. Cohen, F.R.S., of Leeds, in reviewing this address in *Nature* for June 9, 1921, Vol. 107, p. 474, says

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" ..... Prof. Singh, who has himself contributed certain observations on the subject, comes to the conclusion that neither Frankland's theory, nor what he terms "Cohen's rule" accords with the facts; but he omits to point out that both his own and Frankland's observations are made with dissolved substances in which the solvent may, and frequently does modify the rotation, whereas Cohen and his co-workers purposely avoided the use of any solvent ....." Cohen's observations, it is admitted, were made without the use of any solvent, as the substances investigated by him were liquids. This could not be done with the compounds investigated by the writer. In failing to apply Cohen's rule to the cases studied by Singh and his co-workers, the remarkable influence of solvent on the rotatory power is fully discussed (see p. 233 and 234) and it is also one of the factors which makes optical activity and chemical constitution so difficult to correlate. It would appear from Professor Cohen's remarks that the rotatory power should be determined in the pure state without the use of any solvent. Since many of the compounds compared in such investigations are solids at the ordinary temperature, this condition cannot be secured. Again there are some effects, due to the configuration of the molecule, which are only to be observed in solution, as was pointed out by Pickard and Kenyon (T. 1913, *103*, 1923). It would therefore appear interesting to the writer to see to what extent the regularities which have been observed by Cohen in the pure liquid state are maintained in solution.

B. K. S.

PATNA COLLEGE,
PATNA.

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Proceedings of the Annual Meeting, 1921.

FEBRUARY, 1921.

The Annual Meeting of the Asiatic Society of Bengal was held on Wednesday, the 2nd February, 1921, at 9-15 p.m.

MAHAMAHOPADHYAYA HARAPRASAD SHASTRI, M.A., C.I.E., F.A.S.B., President, in the chair.

The following members were present :—

Khan Sahib Abdul Wali, Pandit Amulya Charan Vidyabhusana, The Hon. Justice Sir Asutosh Mookerjee, Kt., Dr. U. N. Brahmachari, Mr. N. C. Chatterjee, Miss M. L. Cleghorn, Mr. H. C. Das-Gupta, Mr. D. A. David, Rev. E. Francotte, Mr. Ganapati Sircar, Mr. T. P. Ghosh, Major E. D. W. Greig, I.M.S., Mr. S. C. Kar, Mr. P. S. MacMahon, Dr. R. C. Majumdar, Mr. J. van Manen, Mr. Panchanan Mitra, Dr. B. Prashad, Mr. Ramaprasad Chanda, Mr. H. C. Roy-Chaudhuri, Kumar Sarat Kumar Roy, Mr. Satyendra Nath Basu, Mr. S. A. Skinner, and others.

Visitors :—Mrs. A. H. Harley, Miss. O. Cleghorn, Mr. C. Cleghorn, Mr. Panchanan Ray, Mr. R. Sahni, and others.

The President ordered the distribution of the voting papers for the election of Officers and Members of Council for 1921, and appointed Mr. P. S. MacMahon and Khan Sahib Abdul Wali to be scrutineers.

The President also ordered the distribution of the voting papers for the election of Fellows of the Society and appointed Dr. R. C. Majumdar and Dr. U. N. Brahmachari to be scrutineers.

The President announced that the Elliott Prize for Scientific Research for the year 1920 would not be awarded as no Essays had been received in competition.

The President also announced that the Barclay Memorial Medal for the year 1921 had been awarded to Sir Leonard Rogers, Kt.

The Annual Report was then presented.

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Annual Report for 1920.

The Council of the Asiatic Society of Bengal has the honour to submit the following report on the state of the Society's affairs during the year ending 31st December, 1920.

Member List.

The number of Ordinary Members in the last list corrected up to 15th June 1920, was 373. The number of Ordinary Members elected during 1920 was 37, of whom 20 were included in the total of 373 in June last. The number of Ordinary Members to be now added is therefore 17, in addition to 1 member who though elected in 1919 paid his entrance fee in 1920, thus a total of 18 Ordinary Members has been shown in the present list. On the other hand, 8 have withdrawn, 10 have died, 7 have been struck off under Rule 38, 15 under Rule 40 and 1 under Rule 41. Of these 19 were deleted from the list published in June, 1920, and the names of 22 members have now been removed. The number of Ordinary Members in the past six years is as follows :—

Year.	Paying.				Non-Paying.			Grand Total.
	Resident.	Non-Resident.	Foreign.	Total.	Life.	Absent.	Total.	
1915	171	188	21	280	25	40	65	445
1916	145	159	18	322	25	60	85	407
1917	150	144	15	309	24	45	69	378
1918	153	145	17	315	24	43	67	382
1919 up to 15th June 1920 ..	141	128	15	281	25	64	89	373
1920 to end of December 1920.	161	134	15	310	26	32	58	368

The following members died during the course of the year :—

Sir Duncan Colvin Baillie, K.C.S.I.; Lieut.-Col. John Manners-Smith, C.V.O.; Mr. Tukaram Krishna Ladu; Maharaja Girijanath Roy; Maharaja Kumar Sundar Bharat Singh; Lieut.-Col. C. R. Stevens, I.M.S.; Lieut.-Col. W. D. Sutherland.

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I.M.S.; Dr. L. P. Tessitori; Dr. Satis Chandra Vidyabhusana; Mr. E. J. Woodhouse.

One member, Dr. N. Annandale, has compounded for his subscriptions during the year.

The number of Special Honorary Centenary members and Associate members remained unchanged, these being 2 and 11 respectively.

There was one death among the Honorary Fellows, viz. Sir Charles Lyall, K.C.S.I. During the year we have elected Prof. T. W. Rhys Davids, LL.D.; Sir Charles Eliot, K.C.M.G.; Prof. A. Foucher, D.Litt.; Sir James Frazer, Kt.; Arthur Keith, Esq., M.D.; Sir Joseph Larmor, Kt.; Prof. Sylvain Levi; R. D. Oldham, Esq., F.R.S.; Sir David Prain, Kt.; Sir Aurel Stein, K.C.I.E.; Prof. J. Takakusu, as Honorary Fellows, making a total of 28.

Fellows of the Society.

Owing to a technical contravention of the Regulations regarding the election of Fellows the Council resolved that no election of Fellows should be held in 1920.

At a meeting of the Fellows of the Society resident in Calcutta held on Thursday, 28th June, 1920, the question of the alteration of certain dates in the Regulations for the election of Fellows was considered, and it was resolved that:—

(1) The suggestion of Dr. Annandale to change 1st October into 1st August be accepted:

(2) The Secretary's suggestions that 1st March should be altered to 1st October in Rule 2; and that for "the end of November," should be substituted "15th November," in Rule 3, be adopted. In Rule 5 the following should be added after the word "fellow," "so as to reach the Society by 31st December."

There were two deaths among the Fellows, viz.:—Mahamahopadhyaya Satischandra Vidyabhusana, Ph.D., and Lieut.-Col. W. D. Sutherland, I.M.S. These names were removed from the last list of Fellows. The number now stands at 38.

Office-Bearers.

In September Major R. B. Seymour Sewell, I.M.S., resigned his post as Biological Secretary of the Society, and Dr. N. Annandale was appointed to act for him until Dr. S. W. Kemp's return. In November Dr. Annandale resigned his offices as Biological and Anthropological Secretary and Dr. Kemp took over the office of the Biological Secretary and agreed to carry on the duties of the Anthropological Secretary until next election. Dr. S. K. Banerji continued as Physical

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Science Secretary during the year except for five months during which he was absent from Calcutta when Dr. G. E. Pilgrim carried on his work. On the death of Dr. Satis Chandra Vidyabhusana in April, Prof. D R. Bhandarkar was appointed Joint Philological Secretary in addition to his office as Treasurer. In June Mr. W. W. K. Page was appointed Treasurer of the Society. Mr. Page continued until he proceeded on leave in August, when Mr. O. Martin succeeded him. Lieut.-Col. D. McCay, I.M.S., left India on leave and in August Major R. Knowles, I.M.S., was appointed to act for him. In May Dr. W. A. K. Christie resigned his office of General Secretary, and Mr. A. H. Harley was appointed in his place. Mr. Harley continued as General Secretary except for one month during which he was absent from Calcutta when Major Sewell performed the duties of the General Secretary.

There have been no other changes among the Officers of the Society since the last annual election.

Office.

Mr. J. H. Elliott continued as Assistant Secretary during the year, and gave prompt attention to the duties of his post.

In March, Babu Nani Lal Manna, despatcher of the Society died and the Council granted his widow a gratuity of Rs. 210 representing six months' pay in consideration of his services since 1892. Babu Probodh Chandra Deb has been appointed on probation in his place.

Maulavi Hafiz Nazir Ahmed, First Travelling Maulavi attached to the Arabic and Persian Search Department, has been granted leave without pay for one year from the 14th December, 1920.

Under Council order the Maulavis together with all the furniture and books belonging to the Search Department have been transferred to the Philological Secretary's house with a view to better control of the work of the Search Department.

Society's Premises and Property.

The Proceedings regarding the acquirement of a portion of the Society's land for the purpose of road-widening in Park Street have now been closed and after due negotiation the Council agreed to accept from the Land Acquisition Collector for the Society the offer of Rs. 65,000 made on behalf of the Calcutta Improvement Trust. In November 1915, the Council accepted an estimate made by the Trust of Rs. 60,000 for the said piece of land. The Asiatic Society was bound by this agreement, but in view of the nature and aims of the Society the Chairman of the Trust consented to increase the purchase price from Rs. 60,000 to Rs. 65,000. This money has been received and invested in Twelve Months Government Treasury Bills.

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In accordance with Rule 64 A a circular was issued to the resident members of the Society intimating the proposal of the Council that a new building be erected on the site of the one now occupied by the Society. The matter was discussed at the General Meeting held on May 5th, 1920, when no objection was raised. In accordance with Rules 64 and 65 another circular with the architects' report, together with a reduced copy of an elevation-sketch of the proposed new building, were sent to the whole body of members for their votes in favour or against. There was only one unfavourable vote. The matter was brought up for final disposal at the General Meeting held on 7th July and carried unanimously.

Mr. T. P. Ghose presented to the Society an enlargement of a photograph of an old ruined Temple called Dumrail in the Sub-division of Satkhira, Khulna district. The framed photograph has been hung in the Society's rooms.

The Council has sanctioned an increase of charges from Rs. 60 to 75 per annum for the maintenance of the Society's 15 electric fans.

Indian Museum.

No presentations were made over to the Indian Museum.

The Director of the Zoological Survey of India was granted permission to send in exchange to the Baroda State Museum and to the Patna Museum certain duplicate specimens from the Society's collection in the Indian Museum.

During the year there has been no change in the Society's Trusteeship, the Hon. Justice Sir Asutosh Mukhopadhyaya, Kt., C.S.I., D.Sc., F.R.A.S., F.R.S.E., F.A.S.B., continuing to be a member of the Board of Trustees on behalf of the Society under the Indian Museum Act X of 1910.

Indian Science Congress.

The Seventh Annual Meeting of the Indian Science Congress was held in Nagpur from 12th to 17th January, 1920, under the presidency of His Honour Sir Benjamin Robertson, K.C.S.I., K.C.M.G., C.I.E., LL.D., I.C.S., Chief Commissioner, Central Provinces. The subscriptions of about 510 members were received; the scientific papers communicated amounted to 89. Abstracts of these are being published by the Congress and copies will be sent to the members.

It was arranged that the Eighth Annual Meeting of the Indian Science Congress should be held at Calcutta in the office of the Geological Survey of India and in the Indian Museum on Jan. 31st, Febr. 1st, 2nd, 3rd, 4th and 5th, 1921. His Excellency the Right Honourable the Earl of Ronaldshay, G.C.I.E., Governor of Bengal, consented to be Patron and the Hon'ble Sir Rajendra Nath Mukerjee, K.C.I.E. was appointed President, and Mr. P. S. Macmahon and Dr. J. L. Simonsen

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Honorary General Secretaries, and Dr. E. P. Harrison, of the Alipore Observatory, Calcutta, and Dr. Hassan Suhrawardy, District Medical Officer of Lillooah, E.I.R., Local Secretaries, and the Hon'ble Sir Asutosh Mookerjee, Kt., Chairman of the Local Committee.

Meetings.

The Society's General Meetings have been held regularly every month, including the recess months of September and October by order of the Council.

Deputation.

On an invitation from the Institut International de Bibliographie, Bruxelles, to send a representative of the Society to a conference to be held at Bruxelles on the 7th September, 1920, and following days, the council appointed Dr. W.A.K. Christie, B.Sc., to represent the Society. It is to be regretted that Dr. Christie was unable to represent the Society owing to the communication from the Society not having reached him in time for the conference.

The Society received an invitation from the Hindi Sahitya Sammilan to attend their meetings at Patna on the 2nd, 3rd and 4th April 1920. Under Council order the notice was placed in the Society's rooms for the information of members.

Agencies.

Mr. Bernard Quaritch has continued as the Society's London Agent. A detailed account of the stock in hand has now been submitted by him together with a statement of the sale proceeds of the *Journal* and *Proceedings*, *Memoirs* and *Bibliotheca Indica* from July 1914 to 30th November 1920 amounting to £208-13-8. Mr. Quaritch has written to the Society that he is reluctantly compelled to give up the agency for the sale of the Society's publications owing to his being pressed for room, as the small amount of sales does not justify his giving up so much space for warehousing the publications of the Society. The matter is before the Council for consideration.

Owing to the war Mr. Otto Harrassowitz, Liepzig, ceased to act as Continental Agent. He has now submitted an account together with a list of the stock in hand of the Society's *Journal* and *Proceedings*, *Memoirs* and *Bibliotheca Indica* showing the sale proceeds from 1st July, 1914 to 1st July, 1920, amounting to £36-9-1 and Rs. 1,477-2-5. He has also asked permission to continue as the Continental Agent and the matter is before the Council for consideration.

During the year the Council has appointed Mr. Paul Geuthner as the Society's Agent in France and six boxes containing the Bibliotheca Indica publications asked for by him have been sent for sale.

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Barclay Memorial Medal.

In terms of the rules for the award of the Barclay Memorial Medal there was no award during the year.

In connection with the award for 1921, the following members were appointed to form a special "Barclay Memorial Medal Committee" to make recommendations to the Council :— Lieut. Col. D. McCay, M.D., I.M.S. ; G. E. Pilgrim, Esq., D.Sc., F.G.S. ; C. C. Calder, Esq., and C. A. Bentley, Esq., M.B., D.P.H., with Dr. S. W. Kemp, B.A., the Biological Secretary, as Chairman.

Under Council order the account of the Barclay Memorial Fund with the Alliance Bank of Simla, Ld., Calcutta Branch, was closed and the Government Papers for Rs. 500 with them together with the credit balance of Rs. 88-9-4 were transferred to the Bank of Bengal, Calcutta, for deposit on account of the fund. The reason for the transfer is that the Council considers it more convenient that all the securities of the Society should be deposited in the same Bank.

Elliott Prize for Scientific Research.

The subject selected for the Elliott Prize for Scientific Research for the year 1920 was Physics and the notification appeared in the *Calcutta Gazette*, dated 14th January, 1920.

In terms of the notification the essays of competitors should have been sent in so as to reach the President of the Society by the end of June, 1920. No essays were received and therefore no prize for 1920 will be awarded at the annual meeting of the Society in February, 1921.

Finance.

The appendix contains the usual statements showing the accounts for the year 1920. Statement No. 21 shows the Balance sheet of the Society and of the different funds administered through it.

The credit balance at the close of the year is Rs. 2,04,902-6-5, against Rs. 2,00,319-11-9 on 31st December 1919. Of this amount Rs. 1,71,000 belongs to the Permanent Reserve, the working balance, exclusive of funds administered for Government, being Rs. 33,902 as against Rs. 30,919 at the end of 1919.

The Society has received the usual grants of Rs. 20,800 and Rs. 5,000 from Government of Bengal and India respectively as under :—

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From Government of Bengal—	Rs.	*Vide* Statement
Anthropological Fund ..	2,000	No. 1
Bureau of Information ..	1,200	,, 5
Oriental Publication Fund No. 1	9,000	No. 9
Do No. 2	3,000	,, 10
Sanskrit MSS. Fund for cataloguing and preservation of MSS. ..	5,600	,, 12
TOTAL ..	20,800	

From Government of India—	Rs.	*Vide* Statement
Arabic and Persian MSS. Fund ..	5,000	No. 13

Statement No. 14 contains an account of the Society's investments in Government Securities which are held in deposit by the Bank of Bengal. We hold 3½% Government Promissory Notes of the face value of Rs. 2,74,200. They cost Rs. 2,73,206-3-10, the average purchase price being Rs. 96-1-6. The market price at the time of writing this report is nominally Rs. 53. We also hold 4% Government Terminable Loan of 1915-16 of Rs. 10,100 purchased at par. In addition we have 3½% Government Promissory Notes of the face value of Rs. 500, belonging to the Barclay Memorial Fund.

Statement No. 15 shows how the current Bank balance is temporarily invested.

In statement No. 16 is shown the money invested in Government Treasury Bills.—Rs. 65,000 received from the Calcutta Improvement Trust being the purchase price of 15 kathas of land acquired for widening Park Street.

Statement No. 17 gives an account of amounts due to and from the Society by way of subscriptions, publications, and contingent charges.

In statement No. 19 is shown the sum reserved, with interest thereon, and kept in deposit with the Chartered Bank of India, Australia and China, London, for printing the Kashmiri Dictionary in London.

The Budget estimates for the year 1920 were :—

Receipts Rs. 24,260, Expenditure Rs. 23,272. The actual receipts are Rs. 26,803-8-5, including the "admission fees," and one "compound subscription," and the actual Expenditure Rs. 24,084-9-7, including "summer clothing," "Gratuity," "Subscription Refunded," and "Coins," which were not provided for in the Budget estimate. The financial position of the Society therefore shows an improvement of nearly Rupees four thousand six hundred over last year.

During the year we have received Rs. 1,600 from Admission fees and one Compound Subscription, and as usual the Permanent Reserve has been increased by Rs. 1,600 (face value)

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transferred from the Temporary Reserve. The Permanent Reserve now stands at Rs. 1,71,000 (face value).

The Budget estimate of probable Receipts and Expenditure for the year 1921 is as follows:—

Receipts	Rs.	25,203
Expenditure	,,	23,002

BUDGET ESTIMATE FOR 1920.

Receipts.

	1920. Estimate.	1920. Actuals.	1921. Estimate.
	Rs.	Rs.	Rs.
Members' Subscriptions ..	9,000	8,201	9,000
Subscriptions for the Society's *Journal and Proceedings* and *Memoirs* ..	1,920	2,040	2,040
Sale of Publications ..	1,200	1,290	1,200
Interest on Investment ..	9,440	10,942	10,213
Rent of Room ..	600	550	650
Miscellaneous	100	161	100
Government Allowance—for publication of papers in *Journal*	2,000	2,000	2,000
Admission fees ..	..	1,360	..
Compound Subscription ..	..	260	..
TOTAL ..	24,260	26,804	25,203

Expenditure.

Salaries	6,842	7,154	7,758
Commission	600	562	600
Stationery	100	192	150
Pension	228	188	180
Light and Fan ..	200	214	200
Taxes	1,500	1,495	1,495
Postage	500	786	500
Freight	300	108	200
Contingencies .. .	400	391	400
Books	600	258	600
Binding	600	594	600
Journal and Proceedings and *Memoirs*	9,000	8,595	9,000
Indexes	200	..	200
Printing (Circulars, etc.) ..	600	441	500
Carried over ..			

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	1919. Estimate.	1921. Actuals.	1922. Estimate.
	Rs.	Rs.	Rs.
Brought forward ..			
Auditor's fee	150	250	250
Petty Repairs	100	9	25
Insurance	344	344	344
Grain Allowance ..	264	162	..
War Bonus	154	454	..
Winter clothing ..	90	122	..
To Personal Account (Written-off and Miscellaneous)	500	1,461	..
Summer Clothing ..		63	..
Gratuity		210	..
Subscription refunded ..		6	..
Coins		25	..
TOTAL ..	23,272	24,084	23,002

We therefore anticipate a profit of rather more than Rs. 2,200. Any expenditure for which provision has not been made might be met from the above surplus.

Library.

The total number of volumes and parts of magazines added to the Library during the year was 2514, of which 173 were purchased and 2341 were either presented or received in exchange.

In January 1916, the Council approved of the transfer of the medical periodicals to the School of Tropical Medicine, on payment of the amount spent by the Society on the purchase of certain old numbers of medical periodicals, including the cost of binding. The School opened during the year and the medical periodicals have been transferred there on receipt of Rs. 714-4-6. This amount has been set aside for completing other scientific series wanting in the Society's set.

On an application from the Leland Junior University, California, asking as a gift a set of the Society's publications from 1914–1919, inclusive, the Council agreed to comply with the request.

Publications.

Six numbers of the *Journal* and *Proceedings* (Vol. XV,1919, No. 7 and Vol. XVI, 1920, Nos. 1–5) were published during the year containing 368 pages and 16 plates.

One number of the *Memoirs* was published, Vol. VII, No. 3, containing 118 pages and 6 plates.

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Two Numismatic Supplements, Nos. XXXIII and XXXIV, were published in the Society's *Journal* and *Proceedings*, Vol. XVI, 1920, Nos. 3 and 5, under the editorship of Mr. W. E. M. Campbell, I.C.S. Some details are noted in the report under "Coins."

No progress has been made in the publication of the Indices to the Society's *Journal* and *Proceedings* and *Memoirs*, since the issue of the Index to the *Journal* and *Proceedings* for Vol. X, 1914. The indices to the Philological portions of the *Journal* and *Proceedings*, Vols. XI-XIII, 1915-17 and the *Memoirs*, Vols. 3 and 5 have now been prepared and they are in the hands of the Joint Philological Secretary for examination.

A circular was issued to all the members of the Society asking whether they were prepared to forego their claim to any of the following classes of the issues of the Society's Memoirs: (a) letters, (b) biological science, (c) physical science, (d) anthropology. Several replies have been received and their contents noted.

Exchange of Publications.

During the year the Council accepted nine applications for exchange of publications, viz.:—(1) From the Natal Museum—the Society's *Journal* and *Proceedings* and *Memoirs* for their *Annals*. (2) From the Librarian in charge of the New Marine Library, Paris—the Society's *Journal* and *Proceedings* and such portions of the Society's *Memoirs* as deal with Biological problems or have a bearing on Marine or Brackish Water Fisheries, for the publications of the library. (3) From the Real Academie de Ciencias y Artes de Barcelona—the Society's *Journal* and *Proceedings* and *Memoirs* for their *Memoirs*, *Bulletin* and *Catalogue*. (4) From the Editor of "Chemical Abstracts"—the Society's *Journal* and *Proceedings* and *Memoirs* for their periodical. (5) From the Burma Research Society—the Society's *Journal* and *Proceedings* only for their *Journal*. (6) From Dansk Naturhistorisk Forening, Copenhagen—the Society's *Journal* and *Proceedings* and *Memoirs* for their *Videnskabelige meddelelser*. The Society has offered the back vols. of the Society's publications in exchange for an equivalent of their publications. (7) From the Durban Museum, Natal—the Society's *Journal* and *Proceedings* and *Memoirs* for their *Annals*. The Society has offered the back vols. of the publications of the Society in exchange for their *Annals* extending over a similar period. (8) From the Straits Branch of the Royal Asiatic Society, Singapore—the Society's *Journal* and *Proceedings* and *Memoirs* for their *Journal*. The Society has offered the back vols. of the publications of the Society in exchange for the back vols. of their *Journal* extend-

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ing over a similar number of years. (9) From the Museum of Comparative Zoology, Cambridge, Massachusetts—the Society's *Journals* and *Proceedings* and *Memoirs* for their publications. The back volumes of the Society's *Journal* and *Proceedings* from Vols. I—XV and *Memoirs* Vols. I—VII have also been sent to the Museum, with a request to send the Society the back volumes of their publications over a similar period. (10) From the University of Illinois Library—the Society's *Journal* and *Proceedings* and *Memoirs* for the publications of the University, including the Natural History Survey Bulletin. The University has been offered the Society's *Journal* and *Proceedings* and *Memoirs* from 1905-1919 in exchange for an equivalent of their publications.

An application from the Superintendent of the Archaeological Survey of Burma was received asking for the Society's publications in exchange for the "Epigraphia Burmanica": as this periodical is included among the publications supplied to the Society by the Archaeological Survey of India in exchange, the Council resolved to send as a presentation to the Survey the Society's *Journal* and *Proceedings* only.

Owing to a change in the Proprietorship of "The Athenaeum," the supply in exchange of this periodical has been stopped.

Philology, etc.

Mr. J. T. Rankin has contributed a paper containing notes and extracts from two volumes of a Dacca Diary found by him in the India Office Library. The Diaries are in two instalments, and cover the periods 1669 to 1682 and 1688 to 1691 respectively. The second instalment of the Diaries is preceded by a historical retrospect and both are illustrated with footnotes. The third instalment of the diaries covers the period 1736 to 1748, and is preceded by a short history of the incidents which took place before Dacca ceased to be the capital of Bengal. The amalgamation of the two trading companies into the United East India Company was effected at this period. otherwise there is nothing of importance to record regarding the English settled in Dacca at this time.

Mr. H. Beveridge has contributed a paper in which he deals with a letter written in Turki. by the Emperor Bábar to his son Kāmrān about the year 1526 A.D. It contains admonitions of a political nature.

An interesting paper on Hindu Astronomical Deities has been published by Mr. G. R. Kaye in which he deals with the main characteristics of the Hindu planetary deities, and the cults connected therewith. He has discussed in this connection the Vedic and post-Vedic deities, various Astronomical myths, Mediæval solar cults, the Geographical distribution of the temples devoted to sun worship, Mediaeval Ritual, Icono-

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graphy of solar deities, the manual symbols, the present practice of sun planetary worship and their various influences.

Anthropology.

Mr. Hornell has contributed to the Memoirs of the Society a paper entitled "the Origins and Ethnological Significance of Indian Boat Designs". The various types of craft now used in India are described, and accounts, gleaned from various sources, given of the models employed in ancient times. The theory that Mediterranean culture has spread eastwards along definite trade routes is discussed in the light of the evidence afforded by boat-design. In an appendix the author has discussed the significance of the Oculus in boat decoration.

The following papers dealing with Anthropology, using the term in a wide sense, have been published in the Journal during the year:—

"A Loom used by the Gaodar Herdsmen of Seistan." By N. Annandale, D.Sc., F.A.S.B. (Vol. XVI, 1920, No. 1).

"The Tigari—a primitive type of boat used in Eastern Bengal". By Baini Prashad, D.Sc. (Vol. XVI, 1920, No. 1).

A note on the above by Maulvi 'Abdu'l Wali (Vol. XVI, 1920, No. 1.)

"Opening Address in a Discussion on the Value of Bodily Measurements in Distinguishing Human Races". By N. Annandale, D.Sc., F.A.S.B. (Vol. XVI, 1920, No. 3).

In the last named paper Dr. Annandale has criticised existing anthropometrical methods. From experience gained in anthropological work in Calcutta he is of the opinion that more attention should be paid to the descriptive part of physical anthropology than to measurements, which he considers to be both necessarily inaccurate and in some points actually misleading.

Biology.

Dr. Annandale and Dr. Baini Prashad have published further notes on freshwater molluscs belonging to genus *Camptoceras*.

No further parts of Dr. Annandale's "Zoological Results of a Tour in the Far East" have appeared during the year but other papers are now in the press and will be issued shortly.

Mr. Kenoyer has contributed notes on *Vallisneria* in which he draws attention to a number of characters by which the European, American and Indian forms can be discriminated.

Mr. Haines has provided descriptions of a number of new species of plants from Bihar and Orissa.

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Physical Science.

The following is a list of the papers published during the year :—

(1) Improvements in Measurements with Quadrant Electrometers. Part II, simplified arrangements for accurate and continuous work.—By V. H. Jackson and A. T. Mukerjee. The paper is a continuation of the authors' work on the same subject published in J.A.S.B., Vol. X, 1914. The authors have considerably simplified the arrangements described in the previous paper for accurate and continuous work.

(2) The Utility of Dessicants in Electrostatic Measurements.—By V. H. Jackson and A. T. Mukerjee. In this paper the authors have tested the relative efficiency of the various dessicants used in electrostatic measurements under strictly uniform conditions using Dolezulek electrometers.

(3) The Purification of Indian Sesame (Til) oil.—By Hashmat Rai and H. B. Dunnicliff. Experiments are described in the paper undertaken with a view (i) to decolorise; (ii) to deodorise, and (iii) to harden the oil by methods capable of commercial application.

(4) Note on Nitrogen. A new method of Preparation.—By Hashmat Rai.

(5) On the Rationalisation of Algebraic Equations.—By Nripendra Nath Chatterjee. The present paper aims at meeting the objection raised by Prof. Mahendra Nath De in a paper published in J.A.S.B., July, 1908, with regard to the method used by the author in an earlier paper on the subject.

(6) The automatic control of the separation of a liquid into fractions limited by specified densities.—By H. B. Dunnicliff. The apparatus which is general in its application was revised by the author to control the run-off of the strong and weak waste acids recovered from the dipping pans used in the manufacture of guncotton by the displacement process.

Medical Section.

Adjourned meetings of the Medical Section were held in October, November and December 1920. Papers were read by Dr. U. N. Bramachari, M.A., M.D., on The Minimum Curative Doses of Quinine when given intravenously in Malaria, on Blood-pressure Observations during such Injections of Quinine, on New Antimonial Preparations in the Treatment of Kala-azar, and on The Resistance of newly formed red Blood Corpuscles to Haemolysis: also by Major R. Knowles, I.M.S., on the Life of Pasteur, and on the Mechanism and Treatment of Snake Bite. The attendance at the adjourned meetings of the Medical Section has been disappointing: and most unfortunately it seems to be the case that when it comes to devoting

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one evening a month to the consideration of scientific medical work and papers many of the leading medical practioners of Calcutta are "otherwise engaged."

International Catalogue of Scientific Literature.

The most important event during the year under this head was the holding of a *Conference* in London with regard to the future of the Catalogue. The Conference was organised by the Royal Society and delegates were invited from the different countries. Dr. H. H. Hayden, C.I.E,, D.Sc., F.R.S., was elected by the Society as its delegate to the Conference. The decision of the Conference has been recently communicated to the Society.

During the year several volumes of the International Catalogue which were detained for want of transport facilities owing to the war were received from the Central Bureau and were despatched to the subscribers in India. Subscriptions covering the value of all copies of the Catalogue received up to date were collected and remitted to the Central Bureau in London.

Index slips of almost all the scientific papers published in Indian Journals for which no slips have been sent to the Central Bureau before have been prepared, thus practically bringing the work up to date. These are being despatched to the Central Bureau.

Bureau of Information.

Very little work was done in this department of the Society's activities, but after the census operations are over a large number of references are expected.

Catalogue of Sanskrit MSS.

Notices of 11,264 MSS. have been written out, their contents arranged according to subjects, and, so far as possible, in chronological order. The second volume, on the Vedas, is in the press, but owing to the paucity of good compositors and the high price of paper the progress is very slow. A second Press is going to be engaged for the third volume, on Smṛti.

Arabic and Persian Manuscript Search and Catalogue.

During the year 1919 no MS. was purchased on behalf of Government.

The Government of India has continued the grant of Rs. 5,000 a year for the next five years for the purposes for which the Research Fund was instituted.

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During the year 1920 the following eight Arabic, Persian and Urdu Manuscripts were purchased on behalf of Government :—(1) *Al-Azhāru'l-Mutanāthira fi'l-Akhbāri'l Mutamātira* by Jalālu'd-Dīn 'Abdu'r-Raḥmān B. Abu Bakr as-Suyūtī. (2) Al-Masā'lu'l-Bahiyyatu'z-Zakiyya 'ala'l-Masā'ili'l-Ithnā 'Asha-riyya by Abu'l Ikhlās Hasan B. 'Ammār al-Wafā'ī ash Shurunhulālī. (3) Kitāb Ādāb al-'Ālim wa'l-Muta'allim fi'l-Mukatahāt. (4) Kitābu'l-Tazkira by Shaykh Khalīfa Shaykh al-Katilūn. (5) Sah'a Sayyarā by 'Alī Rizā Khān. (6) Al-Futūhāt al-Itahiyya by Zakariyya B. Muḥammad al-Ansārī. (7) Dēwān-i-Mirza Tafta. (8) Dēwān-i-Ma'rūf.

The preparation of the Catalogue of the MSS. in the Government collection on the lines of the Catalogue of two collections of Persian and Arabic MSS. preserved in the India Office Library by Sir E. Denison Ross and Professor E. G. Browne is in progress. The Travelling Mawlavies were engaged in this work throughout both years. The amplification of the Society's Catalogue of Persian MSS. continued from the subject reported last is in progress.

Bibliotheca Indica.

The following works have been published in the Bibliotheca Indica :—

The Baudhayana Srautasutram Vol. 3, fas. 3, which has been edited with numerous footnotes by Dr. W. Caland.

The Maitrayaniya Upanisad fas. 2 which was formerly edited by E. B. Cowell has now been revised and re-edited by Mahamahopadhyaya Dr Satis Chandra Vidyabhusana.

The Atmatattvaviveka fas. 3, which is a work on the refutation of Buddhist Metaphysics, has been edited with 6 old Commentaries by Mahamahopadhyaya Vindhyesvari Prasad Dvivedin.

The first of Minor Tibetan Texts contains the Song of the Eastern Snow Mountain in the Tibetan language with an English translation, together with an elaborate glossary and notes by Mr. Johan van Manen.

Under Bardic and Historical Survey of Rajputana Dr. L. P. Tessitori has edited *Chanda rāu Jéta Sī rō Vīthā Sūje ro kiyo* in the *Bibliotheca Indica.* It is a poem composed by Vīṭhū Sīyo Nagarājota, a Cāvaṇa, at the stipend of rāu Jéta Sī of Bikaner, about the year 1535 A.D., to celebrate a victory obtained by the latter prince over Kamrân.

The sixth fasciculus of Udayanācārya's *Nyayavārtikatātparyaparīsuddhi* edited by Mahamahopadhyaya Pandit Vindhyesvari Prasad Dvivedin and Mahamahopadhyaya Lakshamana Sastri Dvavida has come out in No. 1432 of the *Bibliotheca Indica.*

Of the odes of Shaikh Muṣliḥu'd-Din Sa'dī Shirāzī, edited

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by Sir Lucas White King, Kt , C.S.I., LL.D., one fasciculus of the first part (Ṭayyibāt) containing odes 1–153 was published.

'Amal-i-Sāliḥ or Shah Jahān Nama of Muḥammad Ṣāliḥ Kaṃbo, edited by G. Yazdānī, M A., M.R.A.S. Fasciculus IV.

The Akbar-Nāma of Abu'l Fazl—a history of the reign of Akbar including an account of his predecessors, translated from the Persian by Mr. H. Beveridge, I.C.S. (*retired*). Fasciculus, XI.

Coins.

During the year the work of Honorary Numismatist has been carried on by Mr. W. E. M. Campbell, I.C.S , in place of Lieut.-Col. H. R. Nevill, I.C.S., who resigned.

During 1919 Numismatic Supplement No. XXXII was published containing the following papers :—No. 198. Some Rare Mughal Coins, by H. Nevill. No. 199. The Reign of Alāu-d-din Bahman Shāh, by Capt. H. M. Whittell. Two Numismatic Supplements, Nos. XXXIII and XXXIV, have been published during 1920. In these Mr. S. H. Hodivala has continued his valuable work in connection with Mughal Mint Towns. A melancholy interest attaches to the paper by the Rev. Dr. Taylor, on some Shah-i-Hind coins which he had in his possession as it is the last of the long series of numismatic articles which he contributed during many years to our Journal. Dr. Taylor died on 21st Feb., 1920.

A lengthy note has been contributed by Mr. R. D. Banerji on the coins of the Jājapella dynasty. The same author has also published an account of Pratīhāra gold coins, gold coin of Udayadeva, who has been identified with the Paramāra Udayāditya, Alamgirnagar, a new Mughal mint, and Guru-Govinda of Sylhet. Notices of the Nisars of Shahjahan and a new Jaunpur Mohar of Akbar have been contributed by Mr. K. N. Dikshit. A new gold coin of Chandragupta II is the subject matter of a note published by Mr. Prayag Dayal.

No additions of any importance were made to the coin cabinet of the Society during 1919.

The coin cabinet has received few additions during the year. Six 'Ādil Shāhi Copper coins were presented by the Superintendent of the Archaeological Survey, Western Circle, Poona. The Society purchased 4 interesting early Muhammedan silver pieces of possibly, an unknown type. Enquiry is being made regarding them from experts.

The examination of treasure trove from the Central Provinces has been taken over by the staff of the Nagpur Museum.

The Honorary Numismatist reported on a find of 80 Mughal rupees found in Bharatpur State : none was of great interest.

The Society is in full accord with the Archæological Department of the Government of India as regards the necessity

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of keeping catalogues of the coins in public cabinets up to date, and is considering the possibility of producing a supplementary ist of additions made since the publication of the Indian Museum Catalogue.

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Mahamahopadhyaya Haraprasad Shastri, M.A., C.I.E., F.A.S.B., President, delivered an Address to the Society.

Annual Address, 1920.

LADIES AND GENTLEMEN,

You have listened to the Annual Report prepared by the Honorary Secretary, Mr. Harley, who has, for nearly a year, conducted the affairs of the Society with prudence, promptitude and discrimination, for which I shall remain ever grateful to him.

The principal event of the year is the settlement of a misunderstanding which threatened in the beginning of the year to terminate in a protracted law-suit. But thanks to Mr. Harley's tact and judgment an amicable settlement has been arrived at to the satisfaction of both the parties. The Society got some money and the re-building of the boundary wall was done at the expense of the Trust—a concession for which my thanks are due to Mr. Bompas, the Chairman of the Trust.

During the year the building-scheme made some headway. A new scheme has been prepared and the Society has approved of it; and there is a strong Building Committee to push the work on. In the near future, a new palace, five stories high, will be added to the "City of Palaces." It will be a great improvement to the locality. The Society will help materially in increasing the housing accommodation of Calcutta by adding eight flats on the top-floor.

It is often said that the Council of the Asiatic Society is more important than the General Meetings of the Society held at 9-15 P.M. on the first Wednesday of the month. My predecessor, Sir Henry Hayden, thought otherwise and he made it a point to attend every General Meeting where learned papers were read and discussed. I have followed his footsteps, and in these four years there is quite an improvement in the attendance at the General Meetings. And the meetings were often very lively and animated. The popularity of the Society depends on the success of these meetings.

The Medical Section of the Society was in abeyance during the war. It has been revived during the year and there is a good deal of enthusiasm among our Doctors to improve the position of the section. Dr. Knowles and Dr. Brahmachari are at present the heart and soul of the Section. I hope in a short time the Society will find its member-list

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improving. For the abeyance of the Medical Section was one of the principal causes of the loss of members. With these few remarks on the Annual Report I now proceed to read my Address.

The Address :

I rise to-day with tremblings and misgivings. I will this day speak on a vital question of Indian History, Indian Religion and Indian life. The entire Hindu community is interested in it and there are speculations towards its solution by scholars both ancient and modern; but it is still regarded as mysterious and as involved in obscurity. The question is the inclusion of Śiva in the Hindu Pantheon. That he was not a Vedic Deity goes without saying. That he had no share in the sacrifice is beyond question. That he got a share in the sacrifice, after a severe struggle as represented by the Dakṣayajña and its destruction, is certain.

Who is this Śiva ? He is one of the Hindu Trinity. But the other triumvirates have their worlds, their palaces, their gardens, their attendants, their splendour, their power; Śiva however has none of these. He has no Loka, no palace, no garden. He lives at Kailāsa, but he is not the lord of Kailāsa. Kubera is the lord. He is a homeless vagabond, living on cremation and burial-grounds with no other companion than ghosts and goblins and so on. The other members of the Trinity have splendid dresses and ornaments and a complete paraphernalia of godhood. Śiva covers himself with the skin of a tiger and often with the quarters, i.e. he goes naked. Then who is he ? There are so many deities in the Ṛg-Veda, Agni, Vāyu, Varuṇa, Indra, Sūryya, Savitā, the Maruts often called Rudras, and others. But Śiva is nowhere. The Meridian Sun is Viṣṇu, who in later tradition flourishes as the second member of the Trinity. Brahmā is first mantra, then food, then the Supreme Being in the Masculine, and then the all-pervading principle in the Neuter. But Śiva is nowhere.

There is a prevailing notion that the Vedic Rudra is Śiva, but in the Ṛg-Veda, Rudra is almost always used in the plural. They are an assemblage of deities. They are identified with the Maruts, the storm-gods. They are associates of Indra, who loves them as his own children. They are called Rudras, because they screech in the atmosphere. In one place they are said to be born of Rudra in the singular and Pṛṣṇi, the atmosphere god and the goddess of earth. But their paternity is differently explained in the different parts of the Ṛg-Veda. Their number is given nowhere in the Ṛg-Veda. But in later literature they are said to be an assemblage of Eleven Rudras. They have nothing to do with Śiva in the Ṛg-Veda. Rudras are fierce but they may be pacified; and when pacified, they can do an immense amount of good.

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In the two Yajus Saṃhitās, and in one or two hymns of the Rg-Veda, Rudra is often worshipped in the singular. In all parts of India except Bengal, Rudrī or Rudrādhyāya is memorized by every priest from his early childhood. The priests consider this Rudra to be Śiva. They sometimes call him the Chief of the Assembly of Rudras and oftener the twelfth of the Rudras and their lord, the chiefship of the assemblage being assigned to Ganeśa, the elephant-headed son of Śiva. But this does not comprehend all the various aspects of Śiva.

In the later literature, the Śaivas or the followers of Śiva have developed several systems of Śaiva Philosophy, the Lākulīśa being the earliest, the Pāśupatas coming next and the Kaśmīr School coming last of all. The Kaśmir School was founded in the middle of the 9th century, and the Lākulīśa cannot go beyond the 6th. But these sects have absorbed in their works all that was best in the systems of the Hindu, Buddhist and Jaina Philosophies, and developed an Iconography and a system of worship which in richness surpasses all other systems except perhaps the Tāntric cults of Northern India. But even before the development of the oldest School of Śiva cult the Author of Amarakośa gives forty-eight different names for Śiva, showing how widely the worship of the god prevailed in India in the early centuries of the Christian era. He is now worshipped more in his phallic emblem than in images and statues in the round. Though there was some emblem worship in the first few centuries of the first millenium of the Christian era, the worship of the emblem was universalized by Vāsāva, the founder of the Liṅgāyata sect in the 11th century. In earlier centuries the images were more in evidence than the emblem. Even before the commencement of the Christian era Śiva was well known and widely worshipped. Shortly after his birth Buddha was taken to a temple of Maheśvara and Maheśvara came out in person and took Buddha in his arms. Hofrath Bühler, when he heard that the site of the birth-place of Buddha had been identified, sent Rs. 800 from Vienna with instructions to find out the temple of Maheśvara if possible. Kauṭilya mentions Śiva-temples as an indispensable adjunct of every fort. Patañjali makes mention of Śiva, Skanda and Viśākha. So Śiva-worship goes back to the 6th century B.C. Yet he is not mentioned in the ancient Vedas. So he must have his being between the end of the Vedic and before the commencement of the Buddhist period of Indian History.

Is Rudra really our Śiva? The two may be identical in some of the aspects, but in the majority of aspects they differ. The Rudra worship in the Sāmavedī Sandhyā describes him as

ऋतं सत्यं परं ब्रह्म पुरुषं कृष्णपिङ्गलम् ।
ऊर्द्धलिङ्गं विरूपाक्षं विश्वरूपं नमोनमः ॥

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"He is the reality. He is the truth. He is Supreme Brahman. He is Puruṣa. He is black and brown. He belongs to the Upper region. He has abnormal eyes and pervades the Universe." But the later conception

ध्यायेन्नित्यं महेशं रजतगिरिनिभं चारुचन्द्रावतंसम्
रत्नाकल्पोज्ज्वलाङ्गं परशुमृगवराभीतिहस्तं प्रसन्नम् ।
पद्मासीनं समन्तात्स्तुतममरगणैर्व्याघ्रकृत्तिं वसानं
विश्वाद्यं विश्ववीजं निखिलभयहरं पञ्चवक्त्रं त्रिनेत्रम् ॥

"Śiva is like a silver-mountain, moon-crested, with limbs brilliant with the radiance of a variety of precious stones, with four hands holding axe, mṛga, boon-pose, no-fear pose, with a smiling benevolent look, seated on a lotus throne, propitiated with hymns by deities on all sides, with five heads and three eyes, clothed in a tiger-skin, and the beginning and the seed of the Universe." The conceptions materially differ. Who is then Śiva? or Mahādeva with forty-eight different names?

He has eight different Mūrtis, the Earth, Water, Fire, Aiz, Ether, the Sun, the Moon and the Sacrificer under eight different names, Śarvva, Bhava, Rudra, Ugra, Bhīma, Īśāna, Mahādeva and the Paśupati. He sits in all his splendour in the midst of these eight dignitaries and he is daily worshipped by Brāhmaṇas and Brahmanic Hindus. Where is this splendid assemblage to be found?

There is a chapter in the Atharva-Veda, the 15th, which is regarded by all scholars, Indian and European, as mysterious. Its meaning is very little understood. In the midst of a mass of poetry, it is a chapter in prose. In the midst of the archaic Vaidika language, it has the ring of classical fancy. In the midst of incantation, charms and necromancies, it is full of beautiful imagery. In the midst of archaic old-world conceptions, it looks like modern poetry. In the midst of practical sacrificial details, it rises as a work of imagination. It is so wonderful that it strikes everybody who reads the Atharva-Veda; and every one is at a loss to understand what it means, what it imports, what is the idea underlying it. It strikes one as a chapter on the glorification of the Vrātyas. And who is a Vrātya? He is not as we commonly understand him Sāvitrīpatitaḥ, a fallen Aryan, but he is an Aryan outside the Vedic circle, an Aryan outside the Antardeśa, the tract inhabited by the Vedic Aryans. He is on all sides of the Vedic settlement. He has no Brahmanic culture, no trade, no commerce. He is a warrior and a keeper of flocks. He has no permanent settlement and lives in a temporary one called *vrātyās*. They roam about in hordes. They fight the Vedic Aryans. The Vedic Aryans have their bows and

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arrows. These have only bows without the strings. It is in fact a Bānghī or *Bāṅk* with which they fight. The Vedic Aryans had chariots of fine make with a place for the concealment of weapons. They had horse-whips and reins. But the Vrātyas had carts loosely planked over, drawn by horses and mules kept ineffectually under restraint by a *Pratoda*, a stick with a piece of leather-string attached to one end like that still used by our carters. They had peculiarly rude dress, and knew the use of silver ornaments only and not gold.

The Brāhmaṇa of the Sāma-Veda has a long chapter on the purification of these Vrātyas. And curiously enough, when purified they are admitted to all the privileges of the Vedic Society—they can study the Vedas, perform the sacrifices, entertain Brahmins with food cooked by themselves, see mantras and even compile the Brāhmaṇas. The Vrātyas were in fact nomadic hordes of Aryans, but when they assumed a settled life they were fully admitted into the Vedic Society. But they were not allowed to bring in any of their possessions of their nomadic life to their new home. They had to distribute them among their old comrades still continuing in nomad life or among the so-called Brahmins of Magadhadeśa.

The wrong notion that the Vrātyas were a race of fallen Aryans stood in the way of the right understanding of the 15th chapter. The general notion was that it was meant to be a glorification of the Vrātyas. But it is not known whether they were still then in nomad life or settled. But reading the chapter over and over again I found that the Vrātyas induced the creator to look within himself, and he saw Suvarṇa, brilliance. That brilliance increased and grew up, and it became Īśāna, it became Mahādeva, it became Ekavrātya or the totality of the Vrātya community, in other words, the spirit of the Vrātya community, the god of the Vrātya community. The rainbow became his bow, stringless bow like the *bānghīs* of the Vrātyas. With the red outer edge he drove the enemy and with the inner blue edge he cut them.

So the chapter is not exactly the glorification of the Vrātyas, but of their spirit, of their god whom they had lost, as stated in the Brāhmaṇa of the Sāma-Veda. The Maruts instructed them in the Sāmans, the recital of which re-united them with their god and purified them for entrance into the Vedic community. This idea struck me and I read the chapter again and again with increasing interest, eagerness and enthusiasm And wonder of wonders! I found my Śiva there. He is Īśāna, he is Mahādeva. Both these names are familiar to every Hindu. His bow was lying at Mithilā with no string. It is a Vrātya bow, never used with a string. It was Śiva's bow. The king of Mithilā promised the hand of his daughter to any one who could string the bow. No one

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succeeded but Rāma and as a reward he won the daughter of Janaka.

Other clues to the identification of our Śiva with the Ekavrātya followed in rapid succession. He went to the East, certain Sāmans followed him and certain of the gods. Their Sraddhā or the goddess of devotion became his mistress, mantra became his Māgadha or minstrel, supreme consciousness his clothing, day his head-dress, night his hair. His ear-ornaments were of silver (not gold). His precious stone was Kalmali (speckled). The past and present were his footmen running along with his car. His mind was his cart. Mātariśvā and Pavamāna were his draught animals. Wind was his charioteer. Whirlwind was his guiding stick. Fame and reputation were his fore-runners. Thus fully equipped as a Vrātya in spiritualised form he goes to the East. So to the South, so to the West and so to the North, with almost the same accompaniments differing only in a few items. Thus from Antardeśa he went on all sides. This is what represents the four faces of the Mahādeva. In the older legends Mahādeva had four faces and there are still images of Śiva with four faces; often his phallic emblem is endowed with four faces as in Paśupatinātha. But it is said that the Brahmā had five faces, and in a fight Mahādeva snatched away one of his faces and put it on the top of his four, facing upwards. This is again exemplified in the third paragraph of this chapter in which it is said *Urdhvo-atiṣṭhat*, "He stood with his face upwards."

He stood for a year. When the gods said why do you stand?" He said, "Give me Āsamdī (a Chārpoi)." The gods gave him one. The four legs of the Chārpoi were summer, spring, rains and autumn. The two long poles were Vṛhat and Rathantara Sāmans and the two shorter ones were Yajña-Yajñiya and Vāma-Devya Sāman. Ṛks were the long strings, Yajus the short ones. The Vedas were the sheets and mantras the pillows. Sāman was the seat and Udgītha was the support. Gods were attendants by his side and so on. The spirit of Vrātya occupied all that was most sacred in the Vedic society and he is regarded as a source of all the Vedas. He sat on a Chārpoi because the nomad Vrātyas used Chārpois.

But the most striking and convincing clue to the identification is given in the fifth paragraph of the same chapter. The eastern quarter from the Antardeśa gave him Bhava as his servitor, the southern quarter from the same Antardeśa gave him Sarva, the western quarter gave him Paśupati, the northern quarter gave him Ugra, the Dhruva gave him Rudra, upper regions gave him Mahādeva and the whole of the Antardeśa gave him Iśāna. Here we get the seven of the eight mūrtis of Siva, not however representing the five ele-

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ments and the Sun, Moon and the Sacrificer; but Antardeśa the four cardinal points, the Zenith and the Dhruva. There is no Bhīma of the eight mūrtis For I believe the development of the idea of Ākāśa represented by Bhīma was not yet. That Ākāśa is a very late conception is inferred from the way in which Ākāśa has been proved as an entity in Kaṇāda's Vaiśeṣika Darśana. In our daily worship of the eight mūrtis we begin, as in this, from the East, though the names of the presiding deities are not in the same order.

In the same chapter we are told that if a learned Vrātya comes into a house as an Atithi when the Agnihotra is proceeding, the Brahmin householder should receive him with honour and ask his permission for offering oblation to the fire. If he permits, the sacrificer goes on with his work, otherwise not. If he offers oblation with the Vrātya's permission he gets all the fruits of it; if without his permission, he incurs sin. The Vrātya seems to be above all sacrifices. So was Śiva in Dakṣa-Yajña. He did not care whether his father-in-law Dakṣa invited him to the sacrifice or not, whether he gave him a share in the sacrifice or not. But his consort Satī cared for it, and when Dakṣa proceeded with his Yajña without Śiva she gave up her life; and a struggle ensued; all the Universe was agitated and almost destroyed; Dakṣa's head was severed from his body and was substituted by a goat's head. At last, the sacrifice had to be completed with a share assigned to Śiva.

Thus was the spirit of the Vrātya race fully and completely and irrevocably admitted into the Hindu Pantheon. Thus the mystery surrounding the 15th. chapter of the Athar-Veda is to a great extent cleared up and the significance of the legend of the Dakṣa-Yajña realised. Śiva was the god of the nomads and he retains almost all his nomadic habits still. He has no house and no home. He is often ridiculed as a homeless vagabond and he does not disdain to live even in cremation-ground. He is fond of intoxicating drugs. He is not afraid of snakes and serpents, in fact, he lives with them and makes them his ornament. He is the god of the nomad flock-keeper and therefore, rides on the bull. He is a nomad of nomads, the spirit of the nomadic horde. The nomadic Aryans have assumed settled life, but their god has not yet. Kalidāsa says in one place that Śiva revels in all that is regarded as impure, inauspicious and obnoxious by cultured society. All this is because he was the god of the nomad hordes, the Vrātyas.

Under the rules of the Society I now lay down my office and hand it over to Sir Ashutosh Mookerjee, Kt., C.S.I., M.A., D.L., D.Sc., Ph.D., F.A.S.B., Saraswatī, Śāstravācaspati, Sambhuddhāgamachakravartī, a grand personality who has a strong hold on the Government and the High Court, who is

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the life and soul of the University and of the Museum, who carries on the administrations of the Science Association and the Pandits' Association with consummate tact and ability, who is the head of the Imperial Library and of the Calcutta University Institute. And he now brings the Asiatic Society of Bengal with its numerous ramifications within the scope of his many-sided activities.

May this venerable Institution flourish under his care!

—◇—

The President announced the election of Officers and Members of Council for the year 1921, to be as follows :—

President.

The Hon. Justice Sir Asutosh Mukhopadhyaya, Kt., C.S.I., D.L., D.Sc., F.R.S.E., F.R.A.S., F.A.S.B.

Vice-Presidents.

Mahamahopadhyaya Haraprasad Shastri, C.I.E., M.A., F.A.S.B.
P. J. Brühl, Esq., I.S.O., D.Sc., F.C.S., F.G.S., F.A.S.B.
L. L. Fermor, Esq., O.B.E., A.R.S.M., D.Sc., F.G.S., F.A.S.B.
Lieut.-Col. D. McCay, M.D., F.R.C.P., F.A.S.B., I.M.S.

Secretaries and Treasurer.

General Secretary :—A. H. Harley, Esq., M.A.
Treasurer :—O. Martin, Esq.
Philological Secretary :—Dr. A. Suhrawardy, Iftikharul Millat, M.A., F.A.S.B. (Bar-at-Law).
Joint Philological Secretary :—D. R. Bhandarkar, Esq., M.A., F.A.S.B.
Natural History Secretaries :— Biology :—S. W. Kemp, Esq., B.A., D.Sc., F.A.S.B. Physical Science—S. K. Banerji, Esq., D.Sc.
Anthropological Secretary :—Ramaprasad Chanda, Esq., B.A.
Medical Secretary :—Major R. Knowles, I.M.S.
Honorary Librarian :—W. A. K. Christie, Esq., B.Sc., Ph.D., F.A.S.B.

Other Members of the Council.

Upendra Nath Brahmachari, Esq., M.D., M.A., Ph.D.
Ramesh Chandra Majumdar, Esq., M.A., Ph.D.

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Sir R. N. Mookerjee, K.C.I.E.
G. E. Pilgrim, Esq., D.Sc., F.G.S.
P. C. Mahalanobis, Esq., B.Sc., M.A.
E. P. Harrison, Esq., Ph.D., F.Inst.P., F.R.S.E.

The President also announced the election of Fellows to be as follows :—

Lieut.-Col. F. Wall, C.M.G., I.M.S.
U. N. Brahmachari, Esq., M.D., M.A., Ph.D.
B. L. Chaudhuri, Esq., B.A., D.Sc., F.R.S.E., F.L.S.

The Meeting was then resolved into the Ordinary General Meeting.

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LIST OF MEMBERS

OF THE

ASIATIC SOCIETY OF BENGAL

On the 31st December, 1920.

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LIST OF OFFICERS AND MEMBERS OF COUNCIL OF THE ASIATIC SOCIETY OF BENGAL FOR THE YEAR 1920.

President.

Mahāmahopādhyāya Haraprasād Shāstri, C.I.E., M.A., F.A.S.B.

Vice-Presidents.

The Hon'ble Justice Sir Āsutosh Mukhopādhyāya, Kt., C.S.I., D.L., D.Sc., F.R.S.E., F.A.S.B.
F. J. Monahan, Esq., I.C.S.
G. C. Simpson, Esq., D.Sc., F.R.S., F.A.S.B.
N. Annandale, Esq., D.Sc., C.M.Z.S., F.L.S., F.A.S.B.

Secretary and Treasurer.

General Secretary :—A. H. Harley, Esq., M.A.
Treasurer :—Oswald Martin, Esq.,

Additional Secretaries.

Philological Secretary :— Abdulla Al-Ma'mūn Suhrawardy, Esq., Iftikhārul Millat, M.A., Ph.D., F.A.S.B.

Natural History Secretaries. { Biology :—Major R. B. Seymons Sewell, I.M.S., Succeeded by N. Annandale, Esq., D.Sc., C.M.Z.S., F.L.S., F.A.S.B. / Physical Science :—S. K. Banerji, Esq., D.Sc.

Anthropological Secretary :—N. Annandale, Esq., D.Sc., C.M.Z.S., F.L.S., F.A.S.B.
Joint Philological Secretary :—D. R. Bhandarkar, Esq., M.A., F.A.S.B.
Medical Secretary :—Major R. Knowles, I.M.S.
Honorary Librarian :—The Hon. Justice Sir Asutosh Mukhopādhyāya, Kt., C.S.I., D.L., D.Sc., F.R.S.E., F.R.A.S., F.A.S.B.

Other Members of Council.

P. J. Brühl, Esq., I.S.O., D.Sc., F.C.S., F.G.S., F.A.S.B.
E. Vredenburgh, Esq., B.L., D.Sc., A.R.S.M., A.R.C.S., F.G.S., F.A.S.B.
Aga Muhammad Kazim Shirazi.
Upendra Nath Brahmachari, Esq., M.A., Ph.D., M.D.
W. R. Gourlay, Esq., C.I.E., I.C.S.
Ramesh Chandra Majumdar, Esq., M.A., Ph.D.
Sir R. N. Mookerjee, K.C.I E.
G. E. Pilgrim, Esq., D.Sc., F.G.S.

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LIST OF ORDINARY MEMBERS.

R.=Resident. N.R.=Non-Resident. A.=Absent. L.M.=Life Member. F.M.=Foreign Member.

An Asterisk is prefixed to the names of the Fellows of the Society.

N.B.—Members who have changed their residence since the list was drawn up are requested to give intimation of such a change to the Honorary General Secretary, in order that the necessary alteration may be made in the subsequent edition. Errors or omissions in the following list should also be communicated to the Honorary General Secretary.

Members who are about to leave India and do not intend to return are particularly requested to notify to the Honorary General Secretary whether it is their desire to continue Members of the Society; otherwise, in accordance with Rule 40 of the rules, their names will be removed from the list at the expiration of three years from the time of their leaving India.

Date of Election.		
1919 Feb. 5.	N.R.	Abdul Kader Surfraz. *Elphinstone College, Bombay.*
1909 Mar. 3.	R.	Abdul Latif, Khan Bahadur, Syed, Under-Secretary, Government of Bengal, Revenue Dept. *Calcutta.*
1894 Sept. 27.	L.M.	Abdul Wali, Khan Sahib. 3, *Alimuddin Street, Calcutta.*
1915 Feb. 3.	N.R.	Ahmad Ali Khan, Hafiz, Superintendent, Rampur State Library. *Rampur.*
1903 Oct. 28.	A.	Allan, Alexander Smith, M.B. *Europe.* (*c/o Messrs. Smith Stanistreet & Co.*)
1919 July 2.	R.	Amin-ul-Islam, Khan Bahadur, Nawabzada, B.L., *Inspector General of Registration, Bengal.*
1912 July 3.	N.R.	Andrews, Egbert Arthur, B.A. *Tooklai Experimental Station, Cinnenara P.O., Jorhat, Assam.*
1916 Feb. 2.	R.	Andrews, William Edgar, B.A. (Oxon). *La Martinière, Calcutta.*
1904 Sept. 28.	L.M.	*Annandale, Nelson, D.Sc., C.M.Z.S., F.L.S., F.A.S.B., Director, Zoological Survey of India. *Calcutta.*
1911 May 3.	R.	Atkinson, Albert Charles. *La Martinière, 11, Loudon Street, Calcutta.*
1904 July 6.	N.R.	Aulad Hasan, Khan Bahadur, Sayid, [*Dacca.*

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Date of Election.		
1917 April 4.	N.R.	Awati, P. R., M.A., Medical Entomologist, Central Research Institute. *Kasauli.*
1914 Mar. 4.	L.M.	Bacot, I. 31, *Quai d'Orsay, Paris.*
1870 Feb. 2.	L.M.	Baden-Powell, Baden Henry, M.A., C.I.E. *Ferlys Lodge*, 29, *Banbury Road, Oxford, England.*
1919 April 2.	R.	Bal, Surendra Nath. *Calcutta University, Calcutta.*
1918 April 3	N.R.	Ballabhdas, Dewan Bahadur, Banker and Zemindar. *Jubbulpur.*
1920 Mar. 3.	R.	Ballardie, J. H. de Caynoth. 1/1 *Vansittart Row, Calcutta.*
1905 Mar. 1.	R.	Banerji, Muralidhar. *Sanskrit College, Calcutta.*
1918 Feb 6.	N.R.	Banerji, Narendra Nath, Supdt. of Telegraphs. *Nagpur.*
1919 July 2.	R.	Banerji, Pramathanath, M.A., D.Sc. *Calcutta University, Calcutta.*
1919 July 2.	R.	Banerji, Pramathanath M.A. B.L., Vakil, High Court. *Calcutta.*
1907 Jan. 2.	N.R.	Banerji, Rakhal Das, M.A., Supdt., Archæological Survey, Western Circle. *Poona.*
1918 Dec. 4.	R.	Banerji, Sudhangsu Kumar, Ghose Prof. of Applied Mathematics, Calcutta University. *Calcutta.*
1885 Nov. 4.	R.	Barman, Damodar Das. 55, *Clive Street, Calcutta.*
1898 Mar. 2	N.R.	Barnes, Herbert Charles, M.A., I.C.S., Deputy Commissioner, Naga Hills. *Kohima, Assam.*
1909 July 7.	N.R.	Bazuz, Rangnath Khunraj. *Girgaon, [Bombay.*
1895 July 3.	L.M.	Beatson-Bell, The Hon. Sir Nicholas Dodd, B.A., C.I.E., I.C.S., Chief Commissioner of Assam. *Shillong.*
1907 Feb. 6.	N.R.	Bell, Charles Alfred, C.M.G., I.C.S. *The Elms, Darjeeling.*
1915 April 7.	N.R.	Belvalkar, Sripad Krishna, M.A., Ph.D., Prof. of Sanskrit, Deccan College *Poona.*
1909 April 7.	R.	Bentley, Charles A., M.B., D.P.H. *Writers' Building, Calcutta.*
1876 Nov. 15	F.M.	*Beveridge, Henry, F.A.S.B., I.C.S. (retired). *Pitfold, Shottermill, Haslemere, Surrey, England.*
1917 Aug. 1.	R.	*Bhandarkar, Devadatta Ramkrishna, M.A. 16, *Lansdowne Road, Calcutta.*

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Date of Election.		
1908 Nov. 4.	R.	Bhattacharji, Bisvesvar. 22, *Vidyasagar Street, Calcutta.*
1909 July 7.	R.	Bhattacharji, Shib Nath, M.B. 80, *Shambazar Street, Calcutta.* [*Parganas.*
1893 Feb. 1.	L.M.	Bodding, Revd. P. O. *Dumka, Sonthal*
1912 July 3.	R.	Bomford, Capt. Trevor Lawrence, I.M.S., M.B., B.S., M.R.C.S., L.R.C.P. *Eden Hospital. Calcutta.*
1898 Feb. 2.	R.	Bose, Amrita Lal, Dramatist. 9-2, *Ram Chandra Maitra's Lane, Calcutta.*
1918 July 3	R.	Bose, Charu Chandra, Asst. Surgeon, Medical College. 52/2, *Mirzapur St., Calcutta.*
1895 Mar. 6.	R.	*Bose, Sir Jagadis Chandra, Kt., C.S.I., M.A., D.Sc., C.I.E., F.A.S.B. *Presidency College, Calcutta.*
1919 Jun. 6.	R.	Bose, Ojit Mohan, M.B., ch. B. (*Edin.*) 191 *Bow Bazar Street, Calcutta.*
1917 Oct. 3.	R.	Bose, Satyendra Nath, M.Sc. *University College of Science, Calcutta.*
1910 July 6.	N.R.	Botham, Arthur William, I.C.S. *Shillong.*
1908 Jan. 1.	R.	Brahmachari, Upendra Nath, M.A., Ph.D., M.D. 82/3, *Cornwallis Street, Calcutta.*
1920 Sep 1.	N.R.	Brandon, Capt. F.G. *Indian Army, 52nd Sik'sh, F.F. Jullundar.*
1906 July 4.	R.	Brown, Lieut.-Col. Edwin Harold, M.D., I.M.S. (retired). 4, *Harrington Street, Calcutta.*
1907 July 3.	A.	*Brown, John Coggin, F.G.S., M.Sc., F.C.S., Europe. (*c/o Geological Survey of India, Calcutta.*)
1909 Oct. 6.	R.	Brown, Percy, A.R.C.A. *Government School of Art, Calcutta.*
1909 Oct. 6.	R.	*Brühl, Paul Johannes, I.S.O., D.Sc., F.C.S., F.G.S., F.A.S.B. 35, *Ballygunge Circular Road, Calcutta.*
1901 June 5.	F.M.	*Burkill, Isaac Henry, M.A., F.A.S.B. *Botanical Gardens, Singapur.*
1896 Jan. 8.	N.R.	*Burn, Richard, C.I.E., I.C.S., F.A.S.B., Commissioner. *Benares.*
1900 May 2.	N.R.	Butcher, Flora, M.D. Nanda View Cottage, Ranikhet. U. P.
1913 Apl. 2.	R.	Calder, Charles Cumming. *Royal Botanic Gardens, Sibpur, Howrah.*
1901 Mar. 6.	N.R.	Campbell, William Edgar Marmaduke, I.C.S. *Aligarh.*
1918 June 5.	A.	Campbell, Major W. L., I.A., *Europe* (*c/o India Office.*)

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Date of Election.		
1918 July 3.	R.	Campos, Joachim Joseph, M.B. 16/2, *Royd Street, Calcutta.*
1915 Jany. 6.	R.	Carter, Humphry G., M.B., Ch.B., Economic Botanist to the Botanical Survey, Indian Museum. 27, *Chowringhee Road, Calcutta.*
1920 Sep. 1.	R.	Chatterjee, Nirmal Chandra. 52, *Haris Mukerjee Road, Bhowanipore, Calcutta.*
1909 Mar. 3.	R.	Chakravarti, Nilmani, M.A. *Presidency College, Calcutta.*
1905 July 5.	N.R.	Chakravarti, Vanamali. *Cotton College, Gauhati.*
1920 Sep. 1.	R.	Chanda, Ramaprasad, B.A. 37 *A Police Hospital Road, Calcutta.*
1906 Jan. 3.	A.	Chapman, John Alexander. *Europe.* (*c/o Imperial Library, Calcutta.*)
1915 Oct. 27.	N.R.	Chatterjee, Atul Chandra, I.C.S. *Lucknow.*
1908 Feb. 5	R.	Chatterjee, Gopal Chandra, M.B. 1 5, *Premchand Bural Street, Calcutta.*
1911 June 7.	R.	Chatterjee, Karuna Kumar, F.R.C.S. 74, *Dharamtola Street, Calcutta.*
1916 Jan. 5.	R.	Chatterjee, Khagendra Nath, B.A., B.L., Attorney-at-Law. 12, *Madan Mohan Chatterjee Lane, Calcutta.*
1920 Sep. 1.	R.	Chakladar, Haran Chandra. 28/4, *Sahanagar Lane, Kalighat, Calcutta.*
1907 Sept. 25.	R.	Chatterjee, Promode Prakas. 8, *Dixon Lane, Calcutta.*
1893 Sept 28.	R.	Chaudhuri, B. L., B.A., D.Sc. (Edin.), F.R.S.E., F.L.S. (Lond.). 120, *Lower Circular Road, Calcutta.*
1914 April 1.	R.	Chaudhuri, Gopal Das. 32, *Beadon Row, Calcutta.*
1907 July 3	R.	*Christie, William Alexander Kynoch, B.Sc., Ph.D., F.A.S.B. *Geological Survey of India, Calcutta.*
1909 Nov. 3.	N.R.	*Christophers, Major Samuel Richmond, M.B., F.A.S.B., I.M.S. *Research Laboratory, Kasauli.*
1906 Nov. 7.	N.R.	Clarke, Geoffrey Roth, I.C.S., Director General, Posts and Telegraphs. *Simla.*
1915 Sep. 1.	R.	Cleghorn, Maude Lina West, F.L.S., F.E.S. 12, *Alipur Road, Calcutta.*
1920 Dec. 1.	R.	Connor, Lieut. Col. F. P. No. 2, *Upper Wood Street, Calcutta.*
1907 July 3.	A.	Cotter, Gerald de Purcell, B.A., F.G.S. *Europe* (*c/o Geological Survey of India.*)

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Date of Election		
1887 Aug. 25.	R.	Criper, William Risdon, F.C.S., F.I.C., A.R.S.M. *Konnagar, E.I.R.*
1895 July 3.	F.M.	Cumming, Sir John Ghest, K.C.I.E., C.S.I., C.I.E., I.C.S. (retired). *E.I. United Service Club, 16, St James Square, London.*
1873 Dec. 3.	F.M.	Dames, Mansel Longworth, I.C.S. (retired). *Ventnor, Wodeland Road, Guildford, Surrey, England.*
1918 April 3.	N.R.	Das, Jagannath, Ratnakar, B.A., Private Secy. to Srimati Maharani of Ajodhya. *The Rajsadan, Ajodhya.*
1915 Sep. 1.	R.	Das-Gupta, Hem Chandra, M.A., F.G.S., Prof., Presidency College. *Calcutta.*
1896 Mar. 4.	L.M.	Das-Gupta, Jogendra Nath, B.A. (Oxon), Barrister-at-Law. 38/2, *Lower Circular Road, Calcutta.*
1912 April 3.	N.R.	Das, Kasi Nath, Prof., Ravenshawe College. *Cuttack.*
1917 April 4.	R.	Datta, Rasik Lal, D.Sc., Asst. Professor, Calcutta University. 78, *Manicktola St., Calcutta.*
1910 Jan. 5.	R.	David, David A. 55, *Free School St., Calcutta.*
1895 Sept. 19.	N.R.	De, Kiran Chandra, B.A., I.C.S., Commissioner. *Chittagong.*
1917 June 6.	R.	Deb, Kumar Harit Krishna, M.A., Zemindar, Sobhabazar Rajbati. *Raja Navakrishna St., Calcutta.*
1904 Sept. 28.	N.R.	De Courcy, William Blennerhasset. *Leddlesdale Estate, Naduwatum P.O., Nilgiris.*
1906 Dec. 5.	N.R.	Dentith, Arthur William, I.C.S. *Shillong.*
1916 Dec. 6.	R.	Dharmapala, Anagarika, Secretary, Mohabodhi Society. 46, *Baniapooker Lane, Calcutta.*
1910 May 4.	L.M.	Dhavle, Sankara Balaji, I.C.S. *Ranchi.*
1907 Oct. 30.	N.R.	Dixit, Sri Ram, B.A., *Dewan of Banswara, Rajputana.*
1920 Aug. 4.	R.	Dikshit, K. N. *offg: Supdt., Archaeological Survey, Eastern Circle, Calcutta.*
1898 Jan. 5.	R.	Dods, William Kane, Agent, Hongkong and Shanghai Banking Corporation. *Calcutta.*
1919 Nov. 5.	N.R.	Dube, Babool Mayeshanker. *R. N. High School, Fathpur. (Jaipur)*

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Date of Election.		
1909 Nov. 3.	A.	*Donovan, Lieut.-Col. Charles, M.D., I.M.S., F.A.S.B. *Europe.* (*c/o Medical College, Madras.*)
1902 July 2.	R.	Doxey, Frederick. 63, *Park Street, Calcutta.*
1909 Aug. 4.	N.R.	Drake-Brockman, Digby Livingstone, I.C.S. *Saharanpur, U.P.*
1917 June 6.	A.	Dunn, T. O. D. *Europe.* (*c/o Education Dept., Bengal.*)
1914 Sept. 2.	R.	Dutt, B. C. 172, *Manicktola Street, Calcutta.*
1920 April 7.	R.	Dutt, Kumar Krishna. 10, *Hastings Street, Calcutta.*
1910 April 6.	A.	Ebden, Capt. F. T. P., 73*rd Carnatic Infantry. Europe.* (*c/o India Office.*)
1910 April 6.	R.	Elmes, Dr. Cecil H. *Harrington Mansion, Calcutta.*
1911 Nov. 1.	R.	Esch, V. J., Architect. *Victoria Memorial Building, Cathedral Avenue, Maidan, Calcutta.*
1904 Aug. 3.	R.	*Fermor, Lewis Leigh, A.R.S.M., D.Sc., F.G.S., F.A.S.B. *Geological Survey of India, Calcutta.*
1906 Oct. 31.	N.R.	Finlow, Robert Steel, Fibre Expert and Dir. of Agri. *Dacca.*
1907 Mar. 6.	R.	Firminger, The Ven'ble Walter Kelly, M.A., B.D., F.R.G.S., Archdeacon of Calcutta. *St. John's House, Council House Street, Calcutta.*
1913 Nov. 5.	R.	Fox, Cyril S., B.Sc., M I.M.E., F.G.S. *Geological Survey of India, Calcutta.*
1919 April 2.	N.R.	Friel, R., I.C.S. *Jorhat, Assam.*
1903 Mar. 4.	A.	*Gage, Lieut.-Col. Andrew Thomas, M.A., M.B., B.Sc., F.L.S., F.A.S.B., I.M.S. *Europe.* (*c/o Royal Bot. Gardens, Howrah.*)
1893 Jan. 11.	N.R.	*Gait, His Honour Sir Edward Albert, K.C.S.I., C.S.I., C.I.E., F.A.S.B., I.C.S., Lieutenant-Governor of Bihar and Orissa. *Ranchi.*
1919 Feb. 5.	A.	Galoostian, V. M. *Europe.* (*Sanger California.*)
1919 Nov. 5.	N.R.	Gambhir, J. S. *Shamaldas College, Bhavnagar, Kathiawar.*
1912 Mar. 6.	R.	Ganguli, Manmohan, B.E., 50 *Raja Rajballev Street, Calcutta.*
1909 Oct. 7.	R.	Ganguli, Ordhendhu Kumar. 12, *Ganguli's Lane, Calcutta.*

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Date of Election.		
1920 Mar. 3.	N.R.	Ganguli, Capt. P., I.M.S. *Rawalpindi.*
1905 July 5.	R.	Ghosh, Amulya Charan, *Vidyabhusana.* 82, *Manicktolla Street, Calcutta.*
1912 Aug. 7.	R.	Ghosh, Atal Behari, M A., B.L. 59, *Sukea Street, Calcutta.*
1918 Feb. 6.	R.	Ghosh, Ekendra Nath, M.D., M.Sc., Prof. of Biology, Medical College. *Calcutta.*
1907 Mar. 6.	R.	Ghosh, Prafulla Chundra, M.A. *Presidency College, Calcutta.*
1869 Feb. 3.	N.R.	Ghosh, Pratapa Chandra, B.A. *Vindya-* [*chal.*
1920 May 5.	R.	Ghosh, Sukhendro Nath, B.A., B.Sc. 117, *Dharamtollah Street, Calcutta.*
1912 Sept. 4.	R.	Ghosh, Tarapada. 14, *Paddapuker Street, Kidderpur, Calcutta.*
1919 Feb. 5.	N.R.	Ghulam Mohiud-din Sufi. *Normal School, Amraoti.*
1907 Mar. 6.	R.	Goenka, Roormall. 57, *Burtolla Street, Calcutta.*
1920 July 7.	R.	Gourlay, Major C.A., I.M.S. *Presidency General Hospital, Calcutta*
1909 Jan. 6.	R.	Gourlay, William Robert, C.I.E., I.C.S. *Govt. House, Calcutta.*
1910 Sept. 7.	N.R.	*Gravely, Frederic Henry, D.Sc., F.A.S.B. *Govt. Central Museum, Madras.*
1905 May 3.	F.M.	Graves, Henry George, A.R.S.M. 52, *Cradington Road, Bedford, England.*
1910 Mar. 2.	N.R.	*Greig, Major Edward David Wilson, M.B., F.A.S.B , I.M.S. *Simla.*
1900 Dec. 5.	L.M.	Grieve, James Wyndham Alleyne, Deputy Conservator of Forests. *Jalpaiguri.*
1917 June 6.	N.R.	Gupta, Kisorimohan, M.A., Prof. of History, M.C. College. *Sylhet, Assam.*
1919 Mar. 5.	N.R.	Gupta, Siva Prasad. *Satyaupavana, Benares City.*
1915 Aug. 4.	R.	Gurner, C. W., I.C.S. 12, *Store Road, Ballygange, Calcutta.*
1901 Mar. 6.	N.R.	Habibur Rahman Khan, Raees. *Bhikanpur, District Aligarh.*
1892 Jan. 6.	F.M.	Haig, Lieut.-Col. T. Wolseley, C.M.G., Indian Army. H. B. M.'s Legation. *Tehran, Persia.*
1907 Aug. 7.	A.	*Haines, Henry Haselfoot, F.C.H., F.L.S., F.A.S.B. *Europe.*
1908 June 3.	N.R.	Hallowes, Kenneth Alexander Knight, B.A., A.R.S.M., F.G.S., Assistant Superintendent, Geological Survey of India. *Calcutta.*

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Date of Election.		
1916 Jan. 5.	N.R.	Hamilton, C. J. *Patna University, Patna.*
1913 May 7.	N.R.	Hankin, E. H., M.A., D.Sc., *Chemical Examiner, Agra.*
1885 Feb. 4.	L.M.	*Haraprasad Shastri, Mahamahopadhyaya, C.I.E., M.A., F.A.S.B. 26, *Pataldanga Street, Calcutta.*
1920 May 5.	R.	Harcourt, Major E. S. *United Service Club, Calcutta.*
1912 May 1.	R.	Harley, A. H., M.A. *The Madrasah, Calcutta.*
1902 Dec. 3.	N.R.	Harnarain Goswami, Shastri. *Hindu College, Delhi.*
1908 April 1	R.	Harrison, Edward Philip, Ph.D., F.R.S.E. *The Observatory, Alipur, Calcutta.*
1897 Feb. 3.	F.M.	*Hayden, Sir Henry Herbert, Kt., C.I.E., D.Sc., B.A., B.E., B.A.I., F.G.S., F.A.S.B., *Oriental Club, Hanover Square, London.*
1911 June 7.	R.	Hedayat Husain, Shams-ul-Ulama Muhammad. 7-1, *Ramsanker Roy's Lane, Calcutta.*
1919 Nov. 5.	N.R.	Hemraj, Raj Guru. *Dhokatol, Nepal.*
1908 June 3.	R.	Heron, Alexander Macmillan, D.Sc., F.G.S., Assoc. Inst. C.E. *Geological Survey of India, Calcutta.*
1920 Feb. 4.	N.R.	Hill, H. B. C. *P.O. Chabna.* [*Damoh, C.P.*
1911 April 5.	N.R.	Hiralal, Rai Bahadur, B.A., M.R.A.S,
1891 July 1.	N.R.	*Holland, Sir Thomas Henry, K.C.S.I., K.C.I.E., D.Sc., A.R.C.S., F.R.S., F.G.S., F.A.S.B., President, Indian Munitions Board. *Simla.*
1910 Jan. 5.	A.	Hope, Geoffrey D., B.Sc., Ph.D *Europe.* (*c/o Indian Tea Association.*)
1914 Feb. 4.	R.	Hornell, W. W., Director of Public Instruction, Bengal. *Calcutta.*
1920 Dec. 1.	N.R.	Hoti, Major Mohamed Akbar. *Chief of Hoti, P.O. Hoti, N.W.F.P.*
1873 Jan. 2.	L.M.	Houstoun, George L., F.G.S. *Johnstone Castle, Renfrewshire, Scotland.*
1918 Feb. 6.	R.	Hui, Rev. Sramana Wan. 4, *Tiretta Bazar Street, Calcutta.*
1911 Feb. 1.	A.	Insch, Jas. Europe. *c/o Messrs. Duncan Bros. Calcutta.*
1920 Dec. 1.	R.	Ivanow, W. 77, *Elliott Road, Calcutta.*
1904 Jan. 6.	A.	Jackson, Victor Herbert, M.A. *Europe.* (*c/o Patna College, Bankipur*).
1916 Jan. 5.	N.R.	Jain, Kumar Devendra Prasad, Secy. All-India Jain Association. *Arrah.*

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Date of Election.		
1907 Sept. 25.	N.R.	Jenkins, Owen Francis, I.C.S. *Badaun.*
1908 June 3.	R.	Jones, Herbert Cecil, A.R.S.M., A.R.C.S., F.G.S. *Assistant Superintendent, Geological Survey of India, Calcutta.*
1911 Sept. 1.	N.R.	Juggarao, Sree Raja Ankitam Venkata. *Zemindar of Shermahamadpuram, Dabagardens, Vizagapatam.*
1911 Nov. 1.	N.R.	Kamaluddin Ahmed, Shams-ul-Ulama. *Madrasah , Chittagong.*
1891 Feb. 4.	N.R.	Kapur, Raja Ban Behari, C.S.I. *Burdwan.*
1911 Jan. 1.	N.R.	Kaye, George Rusby, F.R.A.S., *Simla.*
1918 July 3.	F.M.	Kazunobu, Kanokoge, Prof. of Philosophy, The Keio University. *Europe.* (*c/o Japanese Consulate, 7, Loudon St., Calcutta.*)
1920 Feb. 4.	R.	Keir, W. I., Asst. Architect to the Govt. of Bengal. *Writers Building Calcutta.*
1910 May 4.	R.	*Kemp, Stanley W., B.A., D.Sc., F.A.S.B. 27 *Chowringhee Road, Calcutta.*
1882 Mar. 1.	N.R.	Kennedy, Pringle, M.A., B.L. *Mozafferpur.*
1918 April 3.	N.R.	Khanna, Ram Nath, c/o Mr. B. Dhani Ram. *Gurgaon.*
1920 Mar. 3.	R.	Khuda Bakhsh, S., Bar.-at-Law. 5, *Elliott Road, Calcutta.*
1909 April 7.	R.	Kilner, John Newport, M.B., L.R.C.S., L.R.C.P. 14, *Garden Reach, Calcutta.*
1920 July 7.	R.	Kar, Sites Chandra. 47, *Corporation Street, Calcutta.*
1920. July 7	R.	Knowles. Major R. 63, *Park Street, Calcutta.*
1910 Mar. 2.	R.	Kirkpatrick, W. *Chartered Bank Buildings, Calcutta.*
1920 Mar. 3.	R.	Lahiri, Jagadindranath. 91, *Upper Circular Road, Calcutta.*
1918 Feb. 6.	N.R.	Laiq Ahmad Ansari, Shaikh, Historical Research Office. *Bhopal.*
1887 May 4.	L.M.	Lanman, Charles Rockwell. 9, *Farrar Street, Cambridge, Massachusetts, U.S. America.*
1919 Nov. 5.	R.	Larmour, F. A. 60, *Bentinck Street, Calcutta.*
1889 Mar. 6.	L.M.	*La Touche, Thomas Henry Digges, B.A., F.G.S., F.A.S.B. *Alfriston Hills Road, Cambridge, England.*
1914 Aug. 5.	R.	Law, Bimala Charan, B.A. 24, *Sukea St., Calcutta.*

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Date of Election.		
1911 Feb. 1.	R.	Law, Narendra Nath, M.A., B.L. 96, *Amherst St., Calcutta.*
1914 July 1.	R.	Law, Satya Charan, M.A., B.L. 24, *Sukea St., Calcutta.*
1902 July 2.	N.R.	Leake, Henry Martin, M.A., F.L.S. *Nawabgunj, Cawnpore.*
1918 June 5.	N.R.	Lees, Donald Hector, I.C.S., *Jalpaiguri.*
1911 May 3.	R.	Lomax, C. E., M.A. *La Martinière, Calcutta.*
1906 Oct. 31.	N.R.	Luard, Lieut.-Col. Charles Eckford, M.A. (Oxon), Indian Army. *Sehore, C.P.*
1870 April 7.	L.M.	Lyman, B. Smith. 708 *Locust Street, Philadelphia, U.S. America.*
1893 Jan. 11.	L.M.	Maclagan, The Hon. Sir Edward Douglas, M.A., K.C.I.E., C.S.I., I.C.S., Lieutenant-Governor of the Punjab. *Lahore.*
1905 Aug. 2.	R.	*McCay, Lieut.-Col. David, M.D., F.A.S.B., I.M.S. 15, *Kyd Street. Calcutta.*
1913 Mar. 5.	N.R.	MacMahon, P. S., M.Sc., B.Sc. *Canning College, Lucknow.*
1893 Jan. 11.	L.M.	Madho Rao Scindia, His Highness Maharajah Colonel Sir, *Alijah Bahadur,* G.C.S.I., G.C.V.O., A.D.C., LL.D., Maharajah of Gwalior. *Jai Bilas, Gwalior.*
1916 June 7.	N.R.	Mahajan, Surya Prasad. *Murarpur, Gaya.*
1920 Mar. 3.	R.	Mahalanobis, Prof. P. C., B.Sc., M.A. 210, *Cornwallis Street, Calcutta.*
1906 Dec. 5.	R.	Mahalanobis, Subodh Chandra, B.Sc., F.R.S.E., F.R.M.S. 210, *Cornwallis Street, Calcutta.*
1911 Mar. 1.	R.	Mahatap, The Hon. Sir Bijoy Chand, K.C.S.I., Maharajadhiraj of Burdwan. 6, *Alipur Lane, Calcutta.*
1918 Aug. 7.	R.	Maitra, Jatindra Nath, Physician and Surgeon, 68/*a, Beadon St., Calcutta.*
1918 Feb. 6.	N.R.	Maitra, Sisir Kumar, Principal, Indian Institute of Philosophy. *Amalner, Bombay Presidency.*
1920 June 2.	R.	Majumdar, N. G. 70, *Russa Road, North, Calcutta.*
1916 Feb. 2.	R.	Majumdar, Narendra Kumar, M.A., Asst. Prof. Calcutta University. *Calcutta.*
1912 Jan. 10.	N.R.	Majumdar, Rai Jadunath, Bahadur, Government Pleader. *Jessore.*
1913 June 4.	R.	Majumdar, Ramesh Chandra, M.A., Ph.D. 16, *Chandranath Chatterji Street, Bhowanipur, Calcutta.*

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Date of Election.		
1918 Feb. 6.	R.	Manen, Johan van, off. Librarian, Imperial Library. *Calcutta.*
1901 June 5.	N.R.	Mann, Harold Hart, D.Sc., M.Sc., F.L.S., Principal, Agricultural College. *Poona.*
1899 Aug. 30.	N.R.	Mannu Lal, Rai Bahadur, Retired Civil Surgeon. *Rai Bareli.*
1919 Oct. 10.	N.R.	Manry, Rev. J. C. *Ewing Christian College, Allahabad.*
1905 Dec. 6.	F.M.	Marsden, Edmund, B.A., F.R.G.S. 12, *Elerdale Road, Hampstead, London.*
1919 Oct. 29.	N.R.	Marten, John Thomas. *Hotel Cecil, Simla.*
1920 Aug. 4.	R.	Martin, Harold 6 and 7 *Clive Street, Calcutta.*
1920 Aug. 4.	R.	Martin, Oswald 6, and 7, *Clive Street, Calcutta.*
1919 June 4.	N.R.	Matthai George. *Govt. College, Lahore.*
1920 Dec. 1.	R.	Mazumdar, B.C. 33/1/c, *Lansdowne Road, Calcutta.*
1917 May 2.	A.	Meerwarth, Dr. A. M. *Europe.*
1886 Mar. 3.	L.M.	Mehta, Roostumjee Dhunjibhoy, C.I.E. 9, *Rainey Park, Ballygunge, Calcutta.*
1884 Nov. 5.	N.R.	*Middlemiss, Charles Stewart, B.A., F.G.S., F.A.S.B. *Kashmir, Srinagar.*
1884 Sept. 3.	A.	Miles, William Harry. *Europe.* (*c/o Messrs. J Mackillican & Co.*)
1912 June 5.	N.R.	Misra, Champaram. *Partabgarh, Oudh.*
1916 Nov. 1.	R.	Mitra, Adar Chandra, B.L. 164, *Bow Street, Calcutta.*
1919 June 4	R.	Mitra, Dr. Amulya Chandra, Medical Practitioner. *Burdwan.*
1919 Nov. 5.	N.R.	Misra, Pramatho Nath, Pleader, *Malda.*
1911 July 5.	N.R.	Misra, Rai Bahadur Pandit Shyam Behari, B.A., I.C.S., Deputy Collector. *Unao, Oudh.*
1906 June 6.	R.	Mitra, Kumar Manmatha Nath. 34 *Shampukur Street, Calcutta.*
1919 April 2.	R.	Mitra, Panchanan. *Bangabasi College, Calcutta.*
1916 Feb. 2.	R.	Mohammad Yusuf, Hashimi, M.A. *The Madrasah, Calcutta.*
1909 May 5.	N.R.	Mohyuddin Ahmad, Abul-Kalam, Azad. *Ranchi.*
1895 July 3.	R.	Monahan, Francis John I.C.S. *Harrington Mansions, Calcutta.*
1906 Dec. 5.	N.R.	More, Major James Carmichael. 51st Sikhs. *Kuwait, Persian Gulf.*
1919 Feb. 5.	R.	Moreno, H. W. B., B A., Ph.D. 12, *Wellesley Street, Calcutta.*

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Date of Election.		
1912 Jan. 10.	R.	Muhammad Kazim Shirazi, Aga. 23, *Lower Chitpur Road, Calcutta.*
1909 Mar. 3.	R.	Mukerjee, Brajalal, M.A., Solicitor. 12, *Old Post Office Street, Calcutta.*
1899 Sept. 29.	R.	Mukerjee, Jotindra Nath, B.A., Solicitor. 3, *Old Post Office Street, Calcutta.*
1916 Mar. 1.	R.	Mukerjee Prabhat Kumar, Bar.-at-Law. 14*a*, *Ramtanoo Bose Lane, Calcutta.*
1898 May 4.	R.	Mukerjee, Sir R. N., K.C.I.E. 7, *Harrington Street, Calcutta.*
1894 Aug. 30.	R.	Mukerjee, Sibnarayan. *Uttarpara, Bally.*
1919 Feb. 5.	N.R.	Mukerjee, Taraknath. *Falka Colliery, Nirshachate P O., Manbhum.*
1886 May 5.	L.M.	*Mukhopadhyaya, The Hon. Justice Sir Asutosh, Kt., C.S.I., M.A., D.L., D.Sc., F.R.S.E., F.R.A.S., F.A.S.B., 77, *Russa Road, (North), Bhowanipur, Calcutta.*
1908 Feb. 5.	R.	Mukhopadhyaya, Girindra Nath, B.A., M.D. 156, *Haris Mukerjee Road, (North), Bhowanipur, Calcutta.*
1892 Dec. 7.	R.	Mukhopadhyaya, Panchanan. 46, *Bechoo Chatterji's Street, Calcutta.*
1906 Mar. 7.	R.	Nahar, Puran Chand, Solicitor. 48, *Indian Mirror Street, Calcutta.*
1920 Feb. 4.	N.R.	Narayan, Brij. *Rose Cottage, Simla.*
1918 Sept. 25.	N.R.	Narayan, Prince Victor N. *Cooch Bihar.*
1916 July 5.	R.	Naseer Hosein Khayal, Syed. 78, *Prinsep St., Calcutta.*
1914 Feb. 4.	R.	Nawab Ali Chaudhury, The Hon. Nawab Syed. 27, *Weston Street, Calcutta.*
1901 Mar. 6.	N.R.	Nevill, Lieut.-Col. Henry Rivers, I.C.S *Cranagh, Simla.*
1917 Mar. 7.	A.	Newton, Rev. R. P., M.A. *Europe.*
1889 Aug. 29.	L.M.	Nimmo, John Duncan. *c/o Messrs. Walter Duncan & Co., 137, West George Street, Glasgow.*
1913 July 2	N.R.	Norton, E. L., I.C.S., District Magistrate. *Orient Club Building, Chowpatti, Bombay.*
1916 Feb. 2.	A.	Oka, Rev. R. *Europe.* (*c/o Bangae & Co. Calcutta.*)
1906 Dec. 5.	R.	O'Kinealy, Lieut.-Col. Frederick, M.R.C.S., (Eng.), L.R.C.P. (Lond.), I.M.S. *Writer's Building Calcutta.*
1915 April 7.	R.	Otani, Count Kozui. (*c/o Consulate-General of Japan, Calcutta.*)

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Date of Election.		
1907 July 3.	A.	Page, William Walter K., Solicitor. *Europe* (*c/o Messrs. Pugh & Co., Calcutta.*)
1920 Aug. 4.	N.R.	Panikker, N. Padmanabha, *Inspector of Fisheries, Travancore.*
1920 Jan. 7.	N.R.	Parameshara Aiyar, S. *Travancore.*
1904 Aug. 3.	N.R.	Parasnis, Rao Bahadur Dattalraya Balwant. *Satara.*
1919 Nov. 5.	R.	Pascoe, E. H., M.A., D.Sc., F.G.S. *Geological Survey of India, Calcutta.*
1910 April 6.	A	Patuck, Pestonji Sorabji, I.C.S. *Europe.* (*c/o India Office.*)
1906 Dec. 5.	A.	Peart, Major Charles Lubé, C.I.E., 106th Hazara Pioneers. *Europe.* (*c/o Board of Examiners.*)
1888 June 6.	L.M.	Pennell, Aubray Percival, B.A., Bar.-at-Law. *Rangoon.*
1877 Aug. 1.	N.R	Peters, Lieut.-Col. Charles Thomas, M.B., I.M.S. (retired). *Dinajpur.*
1889 Nov. 6.	L.M.	*Phillott, Lieut.-Colonel Douglas Craven, Ph.D., F.A.S.B. *Indian Army* (*retired*). *The Bury, Felsted, Essex, England.*
1914 Nov. 4.	R.	Pickford, Alfred Donald. 2, *Hare Street, Calcutta.*
1904 June 1.	R.	Pilgrim, Guy E., D.Sc., F.G.S. *Geological Survey of India, Calcutta.*
1910 Aug. 3.	R.	Podamraj Jain, Raniwalla. 9, *Joggomohan Mullick's Lane, Calcutta.*
1920 April 7.	N.R.	Pradhan, Hariprasad. *Pradhan Cottage, Darjeeling.* [*Calcutta.*
1918 April 3.	R.	Prashad, Baini, D.Sc. *Indian Museum,*
1914 Mar. 4.	A.	Raffin, Alain. *Europe.*
1880 April 7.	N.R.	Rai, Bepin Chandra. *Giridih, Chota Nag-*[*pur.*
1895 Aug. 29.	N.R.	Rai Chaudhuri, Jatindranath M.A., B.L., Zemindar. *Taki, Jessore.*
1920 Mar. 3	N.R.	Raj, B. Sundara. *Madras.*
1920 May. 7.	N.R.	Ram, Kamakhya Dat, 21 *Clyde Road, Lucknow.*
1908 Feb. 5.	A.	Randle, Herbert Neil, B.A. *Europe* [*c/o Queen's College, Benares.*]
1917 June 6.	N.R.	Rangaswami Aiyangar, K. V., Rao Bahadur, Prof. of History and Economics, H.H. The Maharaja's College. *Trivandrum.*
1905 Jan. 4.	N.R.	Rankin, James Thomas, I.C.S., Commissioner. *Dacca.*

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Date of Election.		
1890 Mar. 5.	R.	*Ray, Sir Prafulla Chandra, Kt., D.Sc., F.A.S.B. *University College of Science, Calcutta.*
1917 May 2.	R.	Ray, Kumud Sankar, M.A., B.Sc., M.B., Ch.B (Edin.). 44, *European Asylum Lane, Calcutta.*
1920 Mar. 3.	N.R.	Raye, Narendra Nath. *Bhagalpur.*
1905 May 3.	R.	Richardson, The Hon. Mr. Justice Thomas William, I.C.S. 21, *Belvedere Road, Alipur.*
1918 April 3.	F.M.	Robinson, Herbert C., Director of Museums and Fisheries, Federated Malay States. *Kuala Lumpur.*
1900 April 4.	A.	*Rogers, Lieut-Col. Sir Leonard, Kt., C.I.E., M.D., B.S., F.R.C.P., F.R.C.S., F.A.S.B., F.R.S., I.M.S. *Europe.* (*c/o Medical College, Calcutta.*)
1920 Mar. 3.	R.	Ronaldshay, The Right Hon. the Earl of, Governor of Bengal. *Calcutta.*
1901 Dec. 4.	F.M.	*Ross, Sir Edward Denison, Kt., C.I.E., Ph.D., F.A.S.B., Director, School of Oriental Studies. *London.*
1918 July 3.	R.	Roy, Dr. Bidhan Chandra, M.D., F.R.C.S., M.R.C.P. (Lond.), Lecturer, Campbell Medical School. 36, *Wellington St., Calcutta.*
1903 July 1.	L.M.	Roy, Maharaja Jagadindranath, *Bahadur.* 6, *Lansdowne Road, Calcutta.*
1915 Oct. 27.	R.	Roy, Kaviraj Jamini Bhusan, M.A., M.B. 46, *Beadon St., Calcutta.*
1920 July. 7.	R.	Roy-Chaudhuri, Hem Chandra. 43/2, *Amherst Street Calcutta.*
1910 Sept. 7.	N.R.	Roy, Kumar Sarat Kumar, M.A. *Dayarampur, Rajshahi.*
1919 Feb. 5.	R.	Roy, Srijut Sasadhar. 31, *Haris Mukerjee Street, Bhowanipore, Calcutta.*
1917 Oct. 3.	R.	Saha, Meghnad, M.Sc. *University College of Science, Calcutta.*
1916 April 5.	N.R.	Saha, Radha Nath. 16, *Lachmikundu,* [*Benares City.*
1913 Apl. 2.	N.R.	Sahay, Rai Sahib Bhagvati, M.A., B.L., Offg. Inspector of Schools. *Bhagalpur.*
1911 Nov. 1.	N.R.	Sahni, Rai Bahadur Dayaram, M.A., Supdt. of Archæology. *Jammu, Kashmir.*
1919 Sept. 3.	N.R.	Saksena, Debi Prasad, Sub-Dy. Inspector of Schools. *Farrukhabad.*
1916 July 5.	R.	Sarkar, Ganpati. 69, *Baliaghata Main Road, Calcutta.*

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Date of Election.		
1898 Mar. 2.	N.R.	Sarkar, Jadunath. *Ravenshaw College, Cuttack.*
1920. Aug. 4.	R.	Sarkar, Satyendra Nath. 9, *Clive Street, Calcutta.*
1909 Mar. 3.	R.	Sarvadhikari, Sir Deva Prasad, Kt., C.I.E., M.A., B.L. 2, *Old Post Office Street, Calcutta.*
1911 Jan. 4.	R.	Sarvadhikari, Dr. Suresh Prasad. 79-1, *Amherst St., Calcutta.*
1917 Dec. 5.	R.	Sastri, Ananta Krishna. 56/1*a*, *Sri Gopal Mullick Lane, Calcutta.*
1915 Feb. 3.	A.	Segard, Dr. C. P. *Europe.*
1919 April 2.	R.	Sen, A. C. 80, *Lower Circular Road, Calcutta*
1902 May 7.	R.	Sen, Jogendra Nath, *Vidyaratna*, M.A. 31, *Prasanna Kumar Tagore's Street, Calcutta.*
1914 April 1.	N.R.	Sen-Gupta, Dr. Nares Chandra. *Dacca.*
1897 Dec. 1.	R.	Seth, Mesrovb J. 19, *Lindsay Street, Calcutta.*
1911 July 5.	A.	*Sewell, Major Robert Beresford Seymour, M.R.C.S., L.R.C.P., I.M.S. *Europe* [*c/o Indian Museum, Calcutta.*]
1909 Jan. 6.	A.	Shirreff, Alexander Grierson, B.A., I.C.S. *Europe.* (*c/o India Office.*)
1913 Dec. 3.	R.	Shorten, Capt. James Alfred, B.A., M.B., B.Ch., I.M.S. *Medical College, Calcutta.*
1908 Mar. 4.	R.	Shujaat Ali, Nasirul Mamalik Mirza, Khan Bahadur, Acting Consul-General for Persia. 10, *Hungerford Street, Calcutta.*
1916 Aug. 2.	N.R.	Shukla, Ashwani Kumar, B.A., LL.B., Revenue Officer, Mewar State. *Udaipur.*
1902 Feb. 5.	N.R.	Shyam Lal, Lala, M.A., LL.B., Deputy Collector. *Naimadri, Agra.*
1899 May 3.	N.R.	Silberrad, Charles Arthur, B.A., B.Sc., I.C.S. *Gorakhpur, U.P.*
1913 Mar. 5.	L.M.	*Simonsen, J. L., D.Sc., F.A.S.B. *Forest Research Institute and College, Dehra Dun.*
1909 April 7.	A.	*Simpson, George Clarke, D.Sc., F.A.S.B. *Europe.* (*c/o Meteorological Dept., Simla.*)
1918 Feb. 6.	N.R.	Singh, Badakaji Marichiman. 38, *Khichapokhari, Katmandu, Nepal.*
1894 July 4.	N.R.	Singh, Raja Kushal Pal, M.A. *Narki.*
1912 May 1.	R.	Singh Roy, Rai Lalit Mohan, Bahadur. 15, *Lansdowne Road, Calcutta.*

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Date of Election.		
1899 Aug. 29.	N.R.	Singh, H.H. The Maharaja Sir Prabhu Narain, Bahadur, G.C.I.E., Maharaja of Benares. *Ramnagar Fort, Benares.*
1909 April 7.	N.R.	Singh, Raja Prithwipal, Talukdar of Surajpur. *District Barabanki, Oudh.*
1899 Nov. 6.	L.M.	Singh, H.H. The Hon. Maharaja Sir Rameshwara, Bhahadur, K.C.I.E. *Durbhanga.*
1913 July 2.	N.R.	Singh, Rudradat, M.A., LL.B., Vakil. *Lucknow.*
1894 Feb. 7.	N.R.	Singh, H.H. The Maharaja Vishwa Nath, Bahadur. *Chhatturpur, Bundelkhund.*
1919 Nov. 5.	N.R.	Singh, Shyan Narayan. *Under Secretary to the Government of Bihar and Orissa, Patna, E.I.R.*
1918 Feb. 6	R.	Singha, Kumar Arun Chandra, M.A. 120/3, *Upper Circular Road, Calcutta.*
1918 April 3.	N.R.	Sinha, Raja Bahadur Bhupendra Narayan, B.A. *Nasipur Rajbati, Nasipur P.O.*
1912 Sept. 5.	N.R.	Singhi, Bahadur Singh. *Azimgunj, Murshidabad.*
1898 Aug. 3.	N.R.	Sita Ram, Lala, B.A., Depy. Magistrate. *Allahabad.*
1913 July 2.	N.R.	Sivaprasad, B.A., Offg. Junior Secretary to the Board of Revenue, U.P. *Allahabad.*
1920 June 2.	R.	Skinner, S. A., Engineer and Director, Messrs. Jessop & Co., Ltd. 93, *Clive Street, Calcutta.*
1920 Mar. 3.	N.R.	Smith, P. Bosworth. *Oorgaum P.O.*
1901 Dec. 4.	N.R.	*Spooner, David Brainard, B.A., Ph.D., F.A.S.B. *Simla.*
1904 Sept. 28.	N.R.	Stapleton, Henry Ernest, B.A., B.Sc. *Ranna, Dacca.*
1908 Dec. 2.	R.	Steen, Major Hugh Barkley, M.B., I.M.S. 1, *Upper Wood Street, Calcutta.*
1916 July 5.	R.	Street, W. S. *Messrs. Shaw Wallace & Co., Calcutta.*
1907 June 5.	R.	*Suhrawardy, Abdullah Al-Ma'mūn, Iftikharul Millat, M.A., D.Litt., LL.D., F.A.S.B. Bar.-at-Law. 56, *Mirzapur Street, Calcutta.*
1920 Jan. 7.	R.	Suhrawardy, Hassan, M.D., F.R.C.S.I., L.M. (Rotunda) F.M.S., London, F.C.U., District Medical Officer. *Lillooah, E.I.R.*
1916 Sept. 27.	N.R.	Sutherland, Rev. W. S., D.D., Scottish Universities Mission. *Kalimpong, Darjeeling Dist.*

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Date of Election.		
1919 June 4.	A.	Tacchella, C. F. H. *Europe.* (c/o *Indian Institute of Science, Bangalore.*)
1909 Jan. 6.	R.	Tagore, Kshitindranath, B.A. 6/1, *Dwarkanath Tagore Lane, Calcutta.*
1914 April 1.	R.	Tagore, Prafulla Nath. 1, *Darpanarain Tagore Street, Calcutta.*
1898 April 6.	R.	Tagore, The Hon. Maharaja Sir Prodyat Coomar, Bahadur, Kt. *Pathuriaghatta, Calcutta.*
1904 July 6.	F.M.	Talbot, Walter Stanley, I.C.S. c/o Messrs. H. S. King & Co. 9, *Pall Mall, London, S.W.*
1910 Aug. 3.	N.R.	Tancock, Major Alexander Charles. 31*st Punjabis, Nowshera, N.W.F.P.*
1893 Aug. 31.	N.R.	Tate, George Passman. 56, *Cantonment, Bareilly, U.P.*
1906 Dec. 5.	N.R.	Tek Chand, Dewan, B.A., M.R.A.S., I.C.S., Deputy Commissioner. *Gujranwala, Punjab.*
1878 June 5.	F.M.	Temple, Colonel Sir Richard Carnac, Bart., C.I.E., Indian Army. 9 *Pall Mall, London.*
1911 Mar. 1.	R.	Thomas, F. W., M.A., Ph.D., *Govt. House, Calcutta.*
1909 Aug. 4.	N.R.	Thompson, John Perronet, M.A., I.C.S. *Chief Secretary, Govt. of the Punjab, Lahore.*
1904 June 1.	N.R.	*Tipper, George Howlett, M.A., F.G.S., F.A.S.B. (c/o *Geological Survey of India, Calcutta.*)
1907 Feb. 6.	A.	*Travers, Morris William, D.Sc., F.R.S., F.A.S.B. *Europe.*
1861 June 5.	L.M.	Tremlett, James Dyer, M.A., I.C.S. (retired). *Dedham, Essex, England.*
1917 Dec. 5.	N.R.	Tripathi, Ramprasad, Reader in Modern Indian History. *The University, Allahabad.*
1894 Sep. 27.	R.	Vasu, Nagendra Nath. 20, *Visvakosh Lane, Bagbazaar, Calcutta.*
1901 Mar. 6.	F.M.	*Vogel, Jean Philippe, Litt.D., F.A.S.B. *The University, Leiden, Holland.*
1894 Sept. 27.	L M.	Vost, Lieut.-Col. William, I.M.S., 26, *Crystal Palace Rack Road, Sydenham, London, S.E.*
1902 Oct. 29.	A.	*Vredenburg, Ernest, B.L., B.Sc., A.R.S.M., A.R.C.S., F.G.S., F.A.S.B., Europe c/o (Geological Survey of India. *Calcutta.*)

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Date of Election.		
1907 July 3.	R.	Walker, Harold, A.R.C.S., F.G.S., A.M. Inst.M., Assistant Superintendent, Geological Survey of India. *Calcutta.*
1918 April 3.	N.R.	Wall, Lieut.-Col. F., C.M.G., I.M.S. *U.S. Club, Bangalore.*
1911 Feb. 1.	N.R.	Waters, Harry George, F.R.I.P.H., Chief Medical Officer, E.I.R. *Allahabad.*
1909 Dec. 1.	N.R.	Webster, J. E., I.C.S. *Sylhet, Assam.*
1913 April 2.	R.	White, Bernard Alfred. *Chartered Bank Buildings, Calcutta.*
1915 Jany. 6.	N.R.	Whitehouse, Richard H. *Tuticorin, Madras.*
1906 Sept. 19.	N.R.	Whitehead, Richard Bertram, I.C.S. *Rupar, Umbala, Punjab.*
1915 May 5.	A.	Williams, L. F. Rushbrook, B.A., B.Litt. *Europe.* (*c/o Allahabad University.*)
1919 May 7.	N.R.	Wills, Cecil Upton, B.A., I.C.S. *Nagpur.*
1906 Mar. 7.	N.R.	Woolner, Alfred Cooper, M.A. *Punjab University, Lahore.*
1908 April 1.	R.	Wordsworth, William Christopher. *Presidency College, Calcutta.*
1894 Aug. 30.	N.R.	Wright, Henry Nelson, B.A., I.C.S. Dist. Judge, *Bareilly.*
1911 Aug. 2.	A.	Young, Gerald Mackworth, B.A., I.C.S. *Europe.* (*c/o India Office.*)
1906 June 6.	F.M.	Young, Mansel Charles Gambier. *Khagaul P.O. Dinapore, E.I.R.*
1910 April 6.	N.R.	Young, Capt. Thomas Charles McCombie, M.B., I.M.S. *Shillong, Assam.*
1919 Feb. 5.	N.R.	Yazdani, G. *Hyderabad, Deccan.*
1919 July 2.	N.R.	Zafar Hasan, *Archæological Survey of India, Delhi.*

SPECIAL HONORARY CENTENARY MEMBERS.

Date of Election.	
1884 Jan. 15.	Revd. Professor A. H. Sayce, Professor of Assyriology, Queen's College. *Oxford, England.*
1884 Jan. 15.	Monsieur Émile Senart. 18, *Rue François Ier, Paris, France.*

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HONORARY FELLOWS.

Date of Election.	
1879 June 4.	Dr. Jules Janssen. *Observataire d'Astronomie Physique de Paris, France.*
1895 June 5.	Charles H Tawney, Esq., M.A., C.I.E. *c/o India Office, London.*
1896 Feb. 5.	Professor Charles Rockwell Lanman. 9, *Farrar Street, Cambridge, Massachusetts, U.S. America.*
1899 Dec. 6.	Professor Edwin Ray Lankester, M.A., LL.D., F.R.S. *British Museum (Nat. Hist.), Cromwell Road, London, S W.*
1899 Dec. 6.	Professor Edward Burnett Tylor, D.C.L., LL.D., F.R.S., Keeper, University Museum. *Oxford, England.*
1904 Mar. 2.	Professor Sir Ramkrishna Gopal Bhandarkar, K.C.I.E. *Poona.*
1904 Mar. 2.	Sir George Abraham Grierson, K C.I.E., Ph.D., D.Litt., C.I.E., I.C.S. (retired). *Rothfarnham, Camberley, Surrey, England.*
1906 Mar. 7.	The Right Hon'ble Baron Curzon of Kedleston, M.A., D.C L., F.R.S. 1, *Carlton House Terrace, London, S.W.*
1908 July 1.	Lieut.-Col. Henry Haversham Godwin-Austen, F.R.S , F.Z.S., F.R.G.S., *Nora Godalming, Surrey, England.*
1911 Sept. 6.	Lieut.-Col. Alfred William Alcock, C.I.E., M.B., LL.D., C.M.Z.S., F.R.S., I.M.S. (retd.). *Heathlands, Erith Road, Belvedere, Kent, England.*
1911 Sept. 6.	Prof. Edward George Browne, M.A., M.B., M.R.C.S., L.R.C.P., M.R.A.S. *Pembroke College, Cambridge.*
1911 Sept. 6.	Mahamahopadhyaya Kamakhyanath Tarkavagisa. 111-4, *Shambazar Street, Calcutta.*
1915 Aug. 4.	Prof. Sir Paul Vinogradoff, F.B.A. D.C.L. 19, *Linton Road, Oxford, England.*
1915 Aug. 4.	Sir Patrick Manson, G.C.M.G., M.D., LL.D., F.R.C.P. 21, *Queen Anne Street, Cavendish Square, London, W.*
1915 Aug. 4.	Sir Joseph John Thomson, Kt., O.M., M.A., Sc.D., D.Sc., LL.D., Ph.D. *Trinity College, Cambridge, England.*
1916 Dec. 6.	Dr. G. A. Boulenger, F.R.S., LL.D., British Museum (Nat. Hist.). *Cromwell Road, London, S.W.*
1917 May 2.	Herbert A. Giles, Esq., LL.D., University of Cambridge. *Cambridge.*

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Date of Election.	
1920 Feb. 4.	Sir Charles Eliot, K.C.M.G., C.B., M.A., LL.D., D.C.L. *H.M. Ambassador at Tokyo.*
1920 Feb. 4.	Prof. T. W. Rhys Davids, LL.D., Ph.D., D.Sc. *University College, London.*
1920 Feb. 4.	Prof. Sylvain Levi, Prof., College of France. *Paris.*
1920 Feb. 4.	Sir Aurel Stein, K.C.I.E., Ph.D., D.Litt., D.Sc. *Srinagar, Kashmir.*
1920 Feb. 4.	Prof. A. Foucher, D.Litt., Prof. University of Paris.
1920. Feb. 4.	Arthur Keith, Esq., M.D., F.R.C.S., LL.D., F.R.S., Royal College of Surgeons of England. *Lincoln's Inn Fields, London, W.C. 2.*
1920 Feb. 4.	R. D. Oldham, Esq., F.R.S., F.G.S., F.R.G.S. 1, *Broomfield Road, Kew, Surrey, England.*
1920 Feb. 4.	Sir David Prain, Kt., C.M.G., C.I.E., M.A., M.B., LL.D., F.R.S.E., F.L.S., F.R.S., F.Z.S., M.R.I.A., *Royal Botanic Gardens, Kew, Surrey, England.*
1920 Feb. 4.	Sir Joseph Larmor, Kt., M.P., M.A., D.Sc., LL.D., D.C.L., F.R.S., F.R.A.S. *Cambridge.*
1920 Feb. 4.	Sir James Frazer, Kt., D.C.L. LL.D., Litt.D. 1, *Brick Court, Temple, London, E.C. 4.*
1920 Feb 4.	Prof. J. Takakusu. *Imperial University of Tokyo, Japan.*

FELLOWS.

Date of Election.	
1910 Feb. 2.	N. Annandale, Esq., D.Sc., C.M.Z.S., F.L.S.
1910 Feb. 2.	The Hon'ble Justice Sir Asutosh Mukhopadhyaya, Kt., C.S.I., M.A., D.L., D.Sc., F.R.A.S., F.R.S.E.
1910 Feb. 2.	I. H. Burkill, Esq., M.A., F.L.S.
1910 Feb. 2	Mahamahopadhyaya Haraprasad Shastri, C.I.E., M.A.
1910 Feb. 2.	Sir Thomas Holland, K.C.S.I., K.C.I.E., D.Sc., A.R.C.S., F.G.S., F.R.S.
1910 Feb. 2.	T. H. D. LaTouche, Esq., B.A., F.G.S.
1910 Feb. 2.	Lieut.-Colonel D. C. Phillott, Ph.D., Indian, Army (retired).
1910 Feb. 2.	Sir Prafulla Chandra Ray, Kt., D.Sc.
1910 Feb. 2.	Lieut.-Col. Sir Leonard Rogers, Kt., C.I.E., M.D., B.S., F.R.C.P., F.R.C.S., F.R.S., I.M.S.
1910 Feb. 2.	Sir E. D. Ross, Kt., C.I.E., Ph.D.
1910 Feb. 2.	M. W. Travers, Esq., D.Sc., F.R.S.

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Date of Election.	
1911 Feb. 1.	The Hon. Sir E. A. Gait, K.C.S.I., C.S.I., C.I.E., I.C.S.
1911 Feb. 1.	Sir H. H. Hayden, Kt., C.S.I., C.I.E., D.Sc., B.A., B.E., B.A.I., F.G.S., F.R.S.
1912 Feb. 7.	H. Beveridge, Esq., I.C.S. (retired).
1912 Feb. 7.	Sir J. C. Bose, Kt., C.S.I., C.I.E., M.A., D.Sc.
1912 Feb. 7.	P. J. Brühl, Esq., Ph.D., F.C.S.
1912 Feb. 7.	Capt. S. R. Christophers, I.M.S.
1912 Feb. 7.	Charles Stewart Middlemiss, Esq., B.A., F.G.S.
1912 Feb. 5.	Lieut.-Col. A. T. Gage, I.M.S.
1913 Feb. 5.	E. Vredenburg, Esq., B.I., B.Sc., A.R.S.M., A.R.C.S., F.G.S.
1913 Feb. 5.	J. Ph. Vogel, Esq., Ph.D., Litt.D.
1913 Feb. 5.	Dr. S. W. Kemp, B.A.
1915 Feb. 3.	Major E. D. W. Greig, C.I.E., M.B., I.M.S.
1915 Feb. 3.	G. H. Tipper, Esq., M.A., F.G.S.
1915 Feb. 3.	D. B. Spooner, Esq., Ph.D.
1915 Feb. 3.	H. H. Haines, Esq., F.C.H., F.L.S.
1916 Feb. 2.	Lieut.-Col. C. Donovan, M.D., I.M.S.
1916 Feb. 2.	R. Burn, Esq., C.I.E., I.C.S.
1916 Feb. 2.	L. L. Fermor, Esq., A.R.S.M., D.Sc., F.G.S.
1917 Feb. 7.	G. C. Simpson, Esq., D.Sc., F.R.S.
1917 Feb. 7.	F. H. Gravely, Esq., D.S
1918 Feb. 6.	J. L. Simonsen, Esq., Ph.D.
1918 Feb. 6.	Lieut.-Col. D. McCay, M.D., I.M.S.
1918 Feb. 6.	Abullah Al-Mámun Suhrawardy, Esq., M.A., Ph.D.
1919 Feb. 5.	J. Coggin Brown, Esq., O.B.E., M.I.M.E., F.G.S.
1919 Feb. 5.	W. A. K. Christie, Esq., B.Sc., Ph.D.
1919 Feb. 5.	D. R. Bhandarkar, Esq., M.A.
1919 Feb. 5.	Major R. B. Seymour Sewell, I.M.S.

ASSOCIATE MEMBERS.

Date of Election.	
1875 Dec. 1.	Revd. J. D. Bate. 15, *St. John's Church Road, Folkestone, Kent, England.*
1885 Dec. 2.	Dr. A. Führer, Prof. of Sanskrit, 5, *Dorenbach strasse Bininngen, Basel, Switzerland.*
1899 Nov. 1.	Revd. E. Francotte, S.J. 30, *Park Street, Calcutta.*
1902 June 4.	Revd. A. H. Francke. *Europe.*
1908 July 1.	Rai Sahib Dinesh Chandra Sen, B.A. 19, *Visvakos Lane, Calcutta.*
1910 Sept. 7.	Shamsul Ulama Maulavi Ahmad Abdul Aziz. *Azeez Bag, City-Hyderabad, Deccan.*

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Date of Election.	
1910 Sept. 7.	L. K. Anantha Krishna Iyer, Esq, *Trichur.*
1910 Dec. 7.	Rev. H. Hosten, S.J. 30, *Park Street, Calcutta.*
1915 Mar. 3.	E. Brunetti, Esq. 27, *Chowringhee Road, Calcutta.*
1915 Dec. 1.	Pandit Jainacharya Vijayadharma Surisvaraji, *Yasovijaya Granthamal Office, Benares City.*
1919 Sept. 3.	H. Bruce Hannah Esq., *Bengal Club, Calcutta.*

LIST OF MEMBERS WHO HAVE BEEN ABSENT FROM INDIA THREE YEARS AND UPWARDS.*

* *Rule* 40.—After the lapse of three years from the date of a member leaving India, if no intimation of his wishes shall in the interval have been received by the Society, his name shall be removed from the List of Members.

The following members will be removed from the next Member List of the Society under the operation of the above rule :—

Capt. F. T. P. Elden. 73rd Carnatic Infantry.
Dr. A. M. Meerwarth.
Revd. R. Oka.
Alain Raffin, Esq.
Morris William Travers Esq.

LOSS OF MEMBERS DURING 1920.

By Retirement.

Ordinary Members.

Lieut. Col. Adam Rivers Steele Anderson, I.M.S.
Jnanendro Mohan Ghosh, Esq.
Dr. William Willoughby Kennedy.
David McLean, Esq.
Capt. Owen St. John Moses, I.M.S.
H. St. J. B. Philby, Esq. I.C.S.

By Death.

Ordinary Member.

Maharaja Kamara Sirdar Bharat Singh.

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सन्दर्भ ग्रन्थ
REFRENCE BOOK

RULE 38.

Joseph Orlando Ferrer, Esq.

RULE 40.

Rev. Hilarion Basdekas.
Lieut. Cecil Alexander Boyle, 11th King Edward's Lancers.
The Right Hon'ble Thomas David Carmichael, Baron of Skirling,
Capt. Lewis Cook, I.M.S.
Lieut. Reginald Frankland Francis, I.A.
Capt. Archer Irvine Fortescue, R.A.M.C.
M. van Geuns, Esq.
Herbert Holmwood, Esq., I.C.S. (retired)
Henry Rosher James, Esq., M.A.
William Alfred Murray, Esq., B.A , M.B.
P. A. Rogalsky, Esq.
Imre George Schwaiger, Esq.
Capt. Claude Bayfield Stokes. I.A
Roadway Charles John Swinhoe, Esq.
Lieut.-Col. Joseph Charles Stoelke Vaughan, I.M.S.

RULE 41.

Kaviraj Sri Baman Dasji.

ELLIOTT GOLD MEDAL AND CASH.

RECIPIENTS.

1893 Chandra Kanta Basu.
1895 Yati Bhusana Bhaduri, M.A.
1896 Jnan Saran Chakravarti, M.A.
1897 Sarasi Lal Sarkar, M.A.
1901 Sarasi Lal Sarkar, M.A.
1904 Sarasi Lal Sarkar, M.A. / Surendra Nath Maitra, M.A.
1907 Akshoyakumar Mazumder.
1911 Jitendra Nath Rakshit. / Jatindra Mohan Datta.
1913 Rasik Lal Datta. / Saradakanta Ganguly. / Nagendra Chandra Nag. / Nilratan Dhar.
1918 Bibhutibhushan Dutta, M.Sc.
1919 Dr. Jnanendra Chandra Ghosh.

सन्दर्भ ग्रन्थ
REFRENCE BOOK

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BARCLAY MEMORIAL MEDAL.

Recipients.

1901 E. Ernest Green, Esq.
1903 Major Ronald Ross, F.R.C.S., C.B., C.I.E., F.R.S., I.M.S. (retired).
1905 Lieut.-Colonel D. D. Cunningham, F.R.S., C.I.E., I.M.S. (retired).
1907 Lieut.-Colonel Alfred William Alcock, M.B., LL.D., C.I.E., F.R.S.
1909 Lieut.-Colonel David Prain, M.A., M.B., LL.D., F.R.S., I.M.S. (retired).
1911 Dr. Karl Diener.
1913 Major William Glen Liston, M.D., C.I.E., I.M.S.
1915 J. S. Gamble, Esq., C.I.E., M.A., F.R.S.
1917 Lieut.-Colonel Henry Haversham Godwin-Austen, F.R.S., F.Z.S., F.R.G.S.
1919 N. Annandale, Esq., D.Sc., C.M.Z.S., F.L.S., F.A.S.B.

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[APPENDIX.]

ABSTRACT STATEMENT

OF

RECEIPTS AND DISBURSEMENTS

OF THE

ASIATIC SOCIETY OF BENGAL

FOR

THE YEAR 1920.

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STATEMENT

1920. *Asiatic Society*

Dr.

	Rs. As. P.	Rs. As. P.
To Establishment.		
Salaries	7,153 15 2	
Commission	563 9 0	
Pension	188 0 0	
Grain Allowance	161 12 0	
War Bonus	454 5 5	
Gratuity	210 0 0	
		8,731 9 7
To Contingencies.		
Stationery	191 13 3	
Light and Fans	214 0 6	
Taxes	1,495 0 0	
Postage	785 10 9	
Auditor's fee	250 0 0	
Petty Repairs	8 10 6	
Insurance	343 12 0	
Winter clothing	122 8 0	
Freight	107 13 9	
Summer clothing	63 0 0	
Subscription refunded	6 0 0	
Coins	25 0 0	
Miscellaneous	390 12 0	
		4,004 0 9
To Library and Collections.		
Books	257 9 0	
Binding	593 13 0	
		851 6 0
To Publications.		
Journal and Proceedings, and Memoirs ...	8,595 7 6	
To printing charges of Circulars, etc. ...	440 10 0	
		9,036 1 6
To Personal Account (Written-off) ...	...	1,461 7 9
Balance ...	...	20,4,902 6 5
Total Rs. ...		2,28,987 0 0

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No. 1.

of Bengal. *1920.*

Cr.

	Rs. As. P.	Rs. As. P.
By Balance from last Report		2,00,319 11 9
By Cash Receipts.		
Interest on Investments	10,941 4 0	
Rent of Room	550 0 0	
Publications sold for cash	146 4 0	
Government allowance—for publication of papers in Journal. (Anthropological Fund.)	2,000 0 0	
Miscellaneous	160 13 0	
		13,798 5 0
By Personal Account.		
Members' Subscriptions	9,024 0 0	
Compound Subscription ...	260 0 0	
Subscriptions to Journal and Proceedings, and Memoirs	2,040 0 0	
Admission Fees	1,328 0 0	
Sales on credit	1,430 7 0	
Books (Medical Periodicals)	621 10 6	
Binding (Do.)	92 10 0	
Miscellaneous	72 3 9	
		14,868 15 3
Total Rs. ...		2,28,987 0 0

Oswald Martin,
Hon. Treasurer.

Calcutta, 31*st December*, 1920.

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STATEMENT

1920. Barclay Memorial Fund in Account

From a sum of Rs. 500 odd given in 1896 by the Surgeon
couragement of Medical

Dr.

To Cash Expenditure.

	Rs.	As.	P.	Rs.	As.	P.
Bank's Commission	...			1	4	0
To Balance—						
G.P. Notes (face value)	500	0	0			
Accumulated interest	89	4	4			
				589	4	4
Total Rs. ...				590	8	4

STATEMENT

1920. Servants' Pension

Founded in 1876 as the Piddington Pension Fund,

Dr.

To Cash Expenditure.

	Rs.	As.	P.	Rs.	As.	P.
Pension	8	0	0			
Bank's Commission	0	4	0			
				8	4	0
Balance ...				1,613	11	10
Total Rs. ...				1,621	15	10

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No. 2.

with the Asiatic Society of Bengal. *1920.*

General, I.M.S., for the foundation of a medal for the en-
and Biological Science.

Cr.

		Rs. As. P.	Rs. As. P.
By Balance from last Report—			
G.P. Notes (face value)		500 0 0	
Accumulated interest		74 2 10	
			574 2 10
By Cash Receipt.			
Interest			16 5 6
Total Rs. ...			590 8 4

Oswald Martin,
Hon. Treasurer.

Calcutta, 31st December, 1920.

No. 3.

Fund. *1920.*

with Rs. 500 odd from the Piddington Fund.

Cr.

	Rs. As. P.
By Balance from last Report	1,572 15 10
By Cash Receipt.	
Interest	49 0 0
Total Rs. ...	1,621 15 10

Oswald Martin,
Hon. Treasurer.

Calcutta, 31st December, 1920.

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STATEMENT

1920. *Building*

From a sum of Rs. 40,000 given by the Government of India towards portion of the

Dr.

To Cash Expenditure.

	Rs. As. P.	Rs. As. P.
Solicitor's fee	800 0 0	
Bank's Commission	1 11 0	
		801 11 0
To Balance—		
G. P. Notes (face value)	40,000 0 0	
Treasury Bills (face value)	65,000 0 0	
Accumulated interest	12,797 2 0	
		1,17,797 2 0
Total Rs.		1,18,598 13 0

STATEMENT

1920. *Bureau of Information in Account*

From an annual grant of Rs. 1,200, made by the Govern

Dr.

To Cash Expenditure.

	Rs. As. P.
Balance	3,300 0 0
Total Rs. ...	3,300 0 0

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No. 4.

Fund. *1920.*

the rebuilding of the Society's Rooms, and from the sale of a Society's land.

Cr.

		Rs. As. P.	Rs. As. P.
By Balance from last Report—			
G. P. Notes (face value)		40.000 0 0	
Accumulated interest		12,200 8 0	
			52,200 8 0
By Cash Receipts			
Sale of Land. (15 Kathas)		65,000 0 0	
Interest		1,398 5 0	
			66,398 5 0
TOTAL Rs. ...			... 1,18,598 13 0

OSWALD MARTIN,
Hon. Treasurer.

Calcutta, 31st December, 1920.

No. 5.

with the Asiatic Society of Bengal. *1920.*

ment of Bengal for the salary of the Officer-in-Charge.

Cr.

	Rs. As. P.
By Balance from last Report	2,100 0 0
By Cash Receipt	
Government Allowance	1,200 0 0
TOTAL Rs. ...	3,300 0 0

OSWALD MARTIN,
Hon. Treasurer.

Calcutta, 31st December, 1920.

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STATEMENT

1920. *Anthropological Fund in Account*

This sum is set aside for the purchase of

Dr.

To Cash Expenditure.

	Rs. As. P.	Rs. As. P.
Books		5 5 0
Balance		968 4 3
Total Rs. ...		973 9 3

STATEMENT

1920. *International Catalogue of Scienti-*
Asiatic Society

From the subscriptions of subscribers, and from a sum of Rs. 1,000 given by

Dr.

To Cash Expenditure.

	Rs. As. P.	Rs. As. P.
Salaries	404 0 0	
War Bonus	8 0 0	
Grain Allowance	16 0 0	
Winter clothing	17 6 0	
Contingencies	72 7 6	
Postage	47 8 0	
Freight	145 6 3	
Summer clothing	9 0 0	
Subscriptions remitted to London (£ 262-18-8)	2,799 12 10	
Subscription refunded	110 4 0	
		3,629 12 7
Balance		4,688 3 0
Total Rs. ...		8,317 15 7

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No. 6.

with the Asiatic Society of Bengal. 1920

Anthropological books from the balance of 1918.

Cr.

	Rs.	As.	P.
By Balance from last Report	973	9	3
TOTAL Rs. ...	973	9	3

Calcutta, 31*st December*, 1920. OSWALD MARTIN, *Hon. Treasurer.*

No. 7.

fic Literature in Account with the 1920.
of Bengal.

the Government of Bengal for expenses incurred in connection with the Bureau.

Cr.

	Rs.	As.	P.
By Balance from last Report	1,357	9	7
BY CASH RECEIPT.			
Subscriptions	6,960	6	0
TOTAL Rs. ...	8,317	15	7

Calcutta, 31*st December*, 1920 OSWALD MARTIN, *Hon. Treasurer.*

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STATEMENT

1920 *Indian Science Congress in Account*

From the subscriptions of

Dr.

To Cash Expenditure.

	Rs.	As.	P.	Rs.	As.	P.
Blocks	67	8	0			
Postage	52	9	0			
Bonus	43	0	0			
Printing Charges	1,504	4	0			
Contingencies	53	9	0			
Stationery	5	0	0			
Advance	100	0	0			
				1,825	14	0
Balance				2,808	13	4
Total Rs.				4,634	11	4

STATEMENT

1920. *Oriental Publication Fund, No. 1, in*

From a monthly grant made by the Government of Bengal for the publica
(Rs. 500), and for the publication of Sanskrit

Dr.

To Cash Expenditure.

	Rs.	As	P.	Rs.	As.	P.
Salaries	2,214	4	7			
War Bonus	140	1	10			
Grain Allowance	45	6	6			
Winter Clothing	8	10	6			
Postage	196	0	3			
Contingencies	65	8	0			
Books	10	10	0			
Commission	69	9	3			
Editing Fee	456	0	0			
Light and Fans	26	1	3			
Printing Charges	1,216	7	0			
Stationery	12	4	0			
Summer Clothing	9	0	0			
Freight	5	7	0			
				4,475	6	2
Personal Account (Written-off)				90	6	0
Balance				46,019	13	1
Total Rs. ...				50,585	9	3

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No. 8.

with the Asiatic Society of Bengal. 1920.

members of the Congress.

Cr.

	Rs. As. P.	Rs. As. P.
By Balance from last Report		2,706 7 4
By Cash Receipts.		
Subscriptions, etc.		1,928 4 0
Total Rs. ...		4,634 11 4

Calcutta, 31*st December*, 1920. Oswald Martin, *Hon. Treasurer.*

No. 9.

Acct. with the Asiatic Soc. of Bengal. 1920.

tion of Oriental Works and Works on Instruction in Eastern Languages
Works hitherto unpublished (Rs. 250).

Cr.

	Rs. As. P.	Rs. As. P.
By Balance from last Report		36,185 9 3
By Cash Receipts.		
Government Allowance ...	9,000 0 0	
Sale of Publications	450 5 6	
Advances recovered	160 12 9	
		9,611 2 3
By Personal Account.		
Sales on credit	4,164 4 3	
From Bikanir State for printing Chanda rān Jèta Sī rò Vīḷhū Sūjè rô keyò	624 9 6	
		4,788 13 9
Total Rs. ...		50,585 9 3

Calcutta, 31*st December*, 1920. Oswald Martin, *Hon. Treasurer.*

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STATEMENT

1920. Oriental Publication Fund, No. 2, in

From a monthly grant sanctioned up to March 1922, by the Government of Historical Interest

Dr.

To Cash Expenditure.

		Rs.	As.	P.
Printing Charges		425	1	0
Balance ...		18,311	13	0
Total Rs. ...		18,736	14	0

STATEMENT

1920. Oriental Publication Fund, No. 3, in

From special non-recurring grants made by the Government of Bengal English translation of the Akbar

Dr.

To Cash Expenditure.

	Rs.	As.	P.
Printing Charges	397	9	6
Total Rs. ...	397	9	6

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No. 10.

Acct. with the Asiatic Soc. of Bengal. 1920.

Bengal of Rs. 250 for the publication of Arabic and Persian Works of (without remuneration).

Cr.

	Rs.	As.	P.
By Balance from last Report	15,736	14	0
By Cash Receipts			
Government Allowance	3,000	0	0
Total Rs. ...	18,736	14	0

Calcutta, 31*st December*, 1920. Oswald Martin, *Hon. Treasurer.*

No. 11.

Acct. with the Asiatic Soc. of Bengal. 1920.

in 1908 of Rs. 3,000 and in 1914 of Rs. 2,000, for the publication of an nama (without remuneration).

Cr.

	Rs.	As.	P.
By Balance from last Report	397	9	6
Total Rs. ...	397	9	6

Calcutta, 31*st December*, 1920.

Oswald Martin,
Hon. Treasurer.

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STATEMENT

1920. *Sanscrit Manuscript Fund in Acct.*

From an annual grant of Rs. 3,200, made by the Government of Bengal
krit Manuscripts acquired by the Society for Government; and Rs. 2,400

Dr.

To Cash Expenditure.

		Rs.	As.	P.	Rs.	As.	P.
Salaries		2,097	12	9			
War Bonus		96	3	3			
Grain Allowance		26	15	6			
Contingencies		9	7	0			
Bonus		630	0	0			
Light and Fan		26	1	3			
Insurance		125	0	0			
Purchase of Manuscripts		20	0	0			
Postage		1	12	0			
Winter Clothing		3	12	0	3,036	15	9
Balance ...					13,209	6	3
Total Rs. ...					16,246	6	0

STATEMENT

1920. *Arabic and Persian MSS. Fund in*

From an annual grant of Rs. 5,000 made by the Government of India and
and binding of Arabic and Persian Manuscripts acquired by the
and for the preparation of notices of Arabic and Persian

Dr.

To Cash Expenditure.

	Rs.	As.	P.	Rs.	As.	P.
Salaries	3,933	7	0			
War Bonus	239	8	6			
Grain Allowance	36	3	9			
Contingencies	16	0	0			
Insurance	31	4	0			
Purchase of Manuscripts	530	0	0	4,786	7	3
Balance				9,280	5	4
Total Rs. ...				14,066	12	7

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No. 12.

with the Asiatic Society of Bengal. 1920.

and at present sanctioned to Mar. 31, 1923, for the cataloguing of Sans- from the same Government for the salary of the Officer-in-Charge.

Cr.

		Rs. As. P.	Rs. As. P.
By Balance from last Report			10,640 6 0
By Cash Receipts.			
Government Allowance for Sans. MSS. Preservation ...	...	3,200 0 0	
Government Allowance for Cataloguing	...	2,400 0 0	5,600 0 0
By Personal Account.			
Sale on credit			6 0 0
Total Rs. ...			16,246 6 0

Calcutta, 31st December, 1920.

Oswald Martin,
Hon. Treasurer.

No. 13.

Acct. with the Asiatic Soc. of Bengal. 1920.

sanctioned from April 1919 for another five years, for the cataloguing Society for Government, for the purchase of further manuscripts, manuscripts found in various libraries in India.

Cr.

		Rs. As. P.	Rs As. P.
By Balance from last Report			9,066 12 7
By Cash Receipt.			
Government Allowance			5,000 0 0
Total Rs			14,066 12 7

Calcutta, 31st December, 1920.

Oswald Martin,
Hon. Treasurer.

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STATEMENT

1920. *Invest*

Dr.

	Face Value. Rs. As. P.	Cost. Rs. As. P.
To Balance from last Report	2,84,300 0 0	2,73,206 3 10
TOTAL Rs.	2,84,300 0 0	2,73,206 3 10

FUNDS	PERMANENT RESERVE. Face Value. Rs.	A.	P.	Cost. Rs.	A.	P.	TEMPORARY RESERVE. Face Value. Rs	A	P.	Cost. Rs.	A.	P.	Total. Rs.	A.	P.
Asiatic Society ...	1,71,000	0	0	1,69,685	9	8	71,900	0	0	64,096	4	2	2,33,781	13	10
Building Fund ...	...	..	...	..	...	..	40,000	0	0	38,025	0	0	38,025	0	0
Servants' Pension Fund	1,400	0	0	1,399	6	0	...	..	...	...	...	..	1,399	6	0
TOTAL Rs. ...	1,72,400	0	0	1,71,084	15	8	1,11,900	0	0	1,02,121	4	2	2,73,206	3	10

STATEMENT

1920. *War*

Dr.

	Face Value. Rs. As. P.	Cost. Rs. As. P.
To Balance from last Report	5,000 0 0	5,000 0 0
,, Purchase	50,000 0 0	51,002 14 1
TOTAL Rs. ...	55,000 0 0	56,002 14 1

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No. 14.

ment. *1920.*

Cr.

	Face Value. Rs. As. P.	Cost. Rs. As. P.
By Balance	2,84,300 0 0	2,73,206 3 10
TOTAL Rs. ...	2,84,300 0 0	2,73,206 3 10

Calcutta, 31*st December*, 1920. OSWALD MARTIN, *Hon. Treasurer.*

No. 15.

Bond. *1920.*

Cr.

	Face Value. Rs. As. P.	Cost. Rs. As. P.
By Balance	55,000 0 0	56,002 14 1
TOTAL Rs. ...	55,000 0 0	56,002 14 1

Calcutta, 31*st December*, 1920.

OSWALD MARTIN,
Hon. Treasurer.

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STATEMENT

1920. *Treasury*

Dr.

	Face Value.			Cost.		
	Rs.	As.	P.	Rs.	As.	P.
To Balance from last Report :—						
Bills for 6 months from 11th December, 1919	10,000	0	0	9,750	0	0
Bills for 6 months from 17th December, 1919	5,000	0	0	4,875	0	0
To Purchase :—						
Bills for 12 months from 14th October, 1920	65,000	0	0	61,750	0	0
TOTAL Rs. ...	80,000	0	0	76,375	0	0

STATEMENT

1920. *Personal*

Dr.

	Rs.	As.	P.	Rs.	As.	P.
To Balance from last Report				3,940	2	0
Advances for Postage, etc.				937	5	0
Asiatic Society	14,868	15	3			
Oriental Publication Fund, No. 1 ...	4 788	13	9			
Sanskrit Manuscript Fund	6	0	0			
				19,663	13	0
TOTAL Rs. ...				24,541	4	0

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No. 16.

Bills. *1920.*

Cr.

	Face Value.			Cost.		
	Rs.	As	P.	Rs.	As	P.
By Bank of Bengal	10,000	0	0	9,750	0	0
,, Do.	5,000	0	0	4,875	0	0
By Balance	65,000	0	0	61,750	0	0
TOTAL Rs. ...	80,000	0	0	76,375	0	0

Calcutta, 31st December, 1920.

OSWALD MARTIN, *Hon. Treasurer.*

No. 17.

Account. *1920.*

Cr.

	Rs. As. P.	Rs As. P.
By Cash Receipts	...	19,082 10 11
,, Asiatic Society	1,461 7 9	
,, Oriental Publication Fund, No. 1 ...	90 6 0	
		1,551 13 9

By Balance.	Due to the Society.			Due by the Society.		
	Rs	As.	P.	Rs.	As.	P.
Members ...	3,211	14	1	135	2	0
Subscribers ...	...	..	...	46	11	0
Narsing Chaube (Bill Collector) ...	..	...	...	100	0	0
Miscellaneous ...	1,098	...	9	121	6	6
	4,309	14	10	403	3	6

...		3,906 11 4
TOTAL Rs. ...		24,541 4 0

Calcutta, 31st December, 1920

OSWALD MARTIN,
Hon. Treasurer.

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Digitized by Arya Samaj Foundation Chennai and eGangotri

STATEMENT

1920. *Fixed*

(Bank of Bengal, Park

Dr.

		Rs.	As.	P.
To Balance from last Report		10,000	0	
Interest		175	0	0
TOTAL RS. ...		10,175	0	

STATEMENT

1920. *Fixed*

(Chartered Bank of India,

Dr.

		Rs.	As.	P.
To deposit from 19th April 1920 @ $5\frac{1}{2}$% per annum £1,156-5-0, plus interest £16-1-4 ...	...	10,000	0	0
Interest accrued up to 31st December 1920 £24-10-11.				
TOTAL RS.	...	10,000	0	0

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Digitized by Arya Samaj Foundation Chennai and eGangotri

No. 18.

Deposit. *1920.*

Street Branch, Calcutta.)

Cr.

	Rs. As. P.
By Bank of Bengal	10,175 0 0
TOTAL Rs. ...	10,175 0 0

OSWALD MARTIN,
Hon. Treasurer.

Calcutta, 31st December, 1920.

No. 19.

Deposit. *1920.*

Australia and China, London.)

Cr.

	Rs. As. P.
By Balance: — Principal £1,156-5-0, plus interest £16-1-4 Interest £24-10-11 ..	10,000 0 0
TOTAL Rs. ...	10,000 0 0

OSWALD MARTIN,
Hon. Treasurer.

Calcutta, 31st December, 1920.

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STATEMENT

1920. *Cash*

Dr.

	Rs. As. P.	Rs. As. P.
To Balance from last Report	...	27,060 14
,, Asiatic Society	13,798 5 0	
,, Barclay Memorial Fund	16 5 6	
,, Servants' Pension Fund	49 0 0	
,, Building Fund	66,398 5 0	
,, Bureau of Information ...	1,200 0 0	
,, International Catalogue of Scientific Literature	6,960 6 0	
,, Indian Science Congress	1,928 4 0	
,, Oriental Publication Fund, No. 1 ...	9,611 2 3	
,, Do. do. No. 2 ...	3,000 0 0	
,, Sanskrit MSS. Fund	5,600 0 0	
,, Arabic and Persian MSS. Fund ...	5,000 0 0	
,, Treasury Bills	14,625 0 0	
,, Personal Account	19,082 10 11	
,, Fixed Deposit (Bank of Bengal) ...	10,175 0 0	
		1,57,444 6 8
TOTAL Rs. ...		1,84,505 4 9

STATEMENT

1920. *Balance*

LIABILITIES.

	Rs. As. P.	Rs. As. P.
Asiatic Society	2,04,902 6 5	
Barclay Memorial Fund	589 4 4	
Servants' Pension Fund	1,613 11 10	
Building Fund	1,17,797 2 0	
Bureau of Information	3,300 0 0	
Anthropological Fund	968 4 3	
International Catalogue of Scientific Literature	4,688 3 0	
Indian Science Congress	2,808 13 4	
Oriental Publication Fund, No. 1 ...	46,019 13 1	
Do. do. No. 2 ...	18,311 13 0	
Sanskrit MSS. Fund	13,209 6 3	
Arabic and Persian MSS. Fund	9,280 5 4	
		4,23,489 2 10
TOTAL Rs. ...		4,23,489 2 10

We have examined the above Balance Sheet and the appended detailed accounts with the Books and vouchers presented to us and certify that it is in accordance therewith correctly setting forth the position of the Society as at 31st December, 1920.

Calcutta,
18th June 1921.

MEUGRUS PEAT & Co. } *Auditors.*
Chartered Accountants. }

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No. 20.

Account. *1920.*

Cr.

	Rs.	As.	P.	Rs.	As.	P.
By Asiatic Society	22,623	1	10			
,, Barclay Memorial Fund	1	4	0			
,, Servants' Pension Fund	8	4	0			
,, Building Fund	801	11	0			
,, Anthropological Fund	5	5	0			
,, International Catalogue of Scientific Literature	3,629	12	7			
,, Indian Science Congress	1,825	14	0			
,, Oriental Publication Fund, No. 1 ...	4,475	6	2			
,, Do. Do. No. 2 ...	425	1	0			
,, Do. Do. No. 3 ...	397	9	6			
,, Sanskrit MSS. Fund	3,036	15	9			
,, Arabic and Persian MSS. Fund ...	4,786	7	3			
,, War Bond	51,002	14	1			
,, Treasury Bills	61,750	0	0			
,, Personal Account	937	5	0			
,, Fixed Deposit (Bank of Bengal) ...	175	0	0			
,, Do. (Chartered Bank) ...	10,000	0	0			
				1,65,881	1	
By Balance				18,623	5	7
TOTAL Rs. ...				1,84,505	4	9

OSWALD MARTIN,
Hon. Treasurer.

Calcutta, 31st December, 1920.

No. 21.

Sheet. *1920.*

ASSETS.

	Rs	As.	P.	Rs	As.	P.
*Investment	2,73,206	3	10			
War Bond	56,002	14	1			
Treasury Bills	61,750	0	0			
Personal Account	3,906	11	4			
Fixed Deposit	10,000	0	0			
Cash Account	18,623	5	7			
				4,23,489	2	10
TOTAL Rs. ...				4,23,489	2	10

OSWALD MARTIN,
Hon. Treasurer.

Calcutta. 31st December, 1920.

* Market value at 31st December, 1920, Rs. 1,45,320.

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Liabilities up to 31st December, 1920.

FUNDS.

	Rs.	As.	P.
Asiatic Society	9,521	14	6
Oriental Publication Fund, No. 1	18,611	15	0
Do. Do. No. 2	3,477	10	0
Sans. MSS. Fund	1,731	2	0
Indian Science Congress	20	8	0
TOTAL RS. ...	33,363	1	6

Copy of Certified Statement of Securities in Custody of Bank of Bengal on account of Asiatic Society of Bengal, December 31, 1920 :—

3½ per cent. Loan of 1842-43	16,700
3½ ,, ,, ,, ,, 1854-55	1,54,100
3½ ,, ,, ,, ,, 1865	44,300
3½ ,, ,, ,, ,, 1879	8,000
3½ ,, ,, ,, ,, 1900-1	51,100
*3 ,, ,, ,, ,, 1896-97	500
4 ,, ,, Terminable Loan of 1915-16	10,100
5½ per cent. War Bonds of 1921	5,000
5½ ,, ,, ,, ,, of 1928	50,000
Indian Treasury Bill	65,000
TOTAL RS. ...	4,04,800

[* Cashier's security deposit.]

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PRINCIPAL PUBLICATIONS OF THE SOCIETY.

Asiatic Researches, Vols. I—XX and Index, 1788—1839.
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Journal, Vols. 1—73, 1832—1904.
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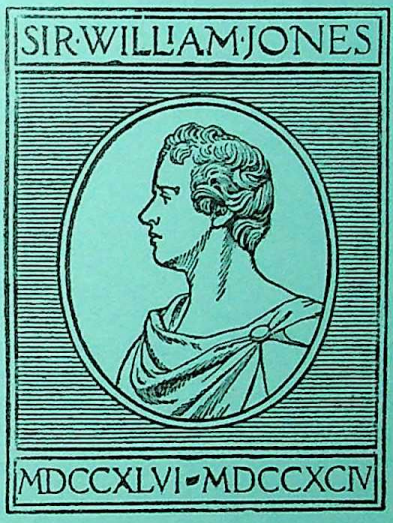

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OF THE

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8. The Svastika and the Oṁkāra.

By Harit Krishna Deb.

[With Plates II–IV.]

On these two themes there exists a considerable body of literature with very little of which I can claim acquaintance in any degree. But, so far as I know, scholars are not yet unanimous regarding the origin and significance of the sacred symbol called *svastika*; and no one seems to have connected the symbol with the mystic syllable *om*. I propose to show that there are indications enabling us to identify the symbol with the syllable; that, in fact, the sign of *svastika* represents the sound of *oṁkāra*.

The syllable *om*, also called *udgītha* or *praṇava*, is part and parcel of the Vedic religion, and the question of its origin early occupied the minds of the Indo-Aryans. In Aitareya Brāhmaṇa V. 32, for example, it is related that Prajāpati, after his meditation had brought into existence the three Vedas, meditated again on them with the result that from the Ṛgveda arose *bhūr*, from the Yajurveda *bhuvaḥ*, from the Sāmaveda *svaḥ*. Upon further meditation on these three products, three letters were brought forth, namely, *a u*, and *ma*. Prajāpati combined the letters, and *Om* was born. The Gopatha Brāhmaṇa (Chap. 1) has much to say regarding the mystic syllable, and, looking at it more from the viewpoint of meaning than from the viewpoint of grammatical form, connects it with $\sqrt{\bar{a}p}$, so that the syllable is held to signify 'attainment of everything' (*rūpasāmanyād-arthasāmānyan-– nedīyas-tasmād-āper-oṁkāraḥ sarvam-āpnotīty-arthaḥ*). One of the earliest Upanishads, the Chāndogya, asserts at the outset of its disquisition that the udgītha is the quintessence (literally, 'the eighth essence') of the universe and is also the object of worship *par excellence*. It is even claimed (Chānd. 1. 4. 4.) that the *devas* became immortal and free from fear by resorting to the syllable *om*. Later Upanishads eulogize the syllable with increasing elaboration. 'The place of knowledge of the Veda is taken by meditation on that word which "all the Vedas proclaim to us" (*sarve vedā yatpadam-ānamanti*), the praṇava, i.e. the sacred syllable *om*.'[1]

The antiquity of the svastika-mark in India likewise goes back at least to the days of Pāṇini, who is now thought by

[1] Deussen, *Philosophy of the Upanishads*, p. 392.

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many scholars to have lived in the 7th century B.C.[1] Pāṇini refers in his Grammar (VI. 3. 115) to the practice of marking cattle with the svastika-symbol.[2] The svastika has long been a favourite emblem with the Jains whose traditions represent it as having been the special sign of Supārsvanātha,[3] a Tīrthaṅkara who is said to have flourished considerably anterior to the period of Mahāvīra (died 528 B.C.).[4] One at least of the gold-leaf ornaments associated with the Piprāhwā vase containing the relics of Buddha is embossed with a svastika.

There are two principal forms of the svastika: (1) that with the arms turned to the right, and (2) that with the arms turned to the left. Analysing each of these two forms we find it composed of two identical elements, 𑀳 or 𑀵, superposed cross-wise. We are at once reminded of the Brāhmī *o* which is written 𑀳 or 𑀵 in the earliest known Indian inscriptions. The idea suggests itself that the svastika is composed of nothing but two Brāhmī *o*'s crossing each other. It will be recalled that in pronouncing the praṇava in course of recitation of the Vedic texts, the *o*-sound is lengthened; and there can be little doubt that Vedic texts, handed down orally with wonderful textual accuracy through thousands of years, are recited in India now nearly as exactly as of yore[5]. Pāṇini teaches the same thing in his rule *om-abhyādāne* (VIII. 2. 7.), and the Gopatha Brāhmaṇa (1. 17) also says: .... *tisro mātrā abhyādāne hi plavate*. If, therefore, this long sound of *o* was required to be represented alphabetically, the sign for *o* would need to be repeated. The repetition might be indicated by writing two *o*'s one after the other: but such a device seems to have been repugnant to the scriptal scheme of ancient India; for two identical vowels have never, I think, been found placed side by side in that way in her antique records. Such a mode of representation would, besides, be cumbersome and in conflict with the requirements of symbolism. The other and simpler method of representation of the long sound of *o*, which may be called the monogrammatic method, would consist in placing two *o*'s crosswise, giving rise to the forms 卐 and 卍 (according as 𑀳 or 𑀵 was taken to stand for *o*) which are precisely the principal forms of the svastika. [See Plate II.] To complete this alphabetic representation of the oṁkāra, pronounced with a nasal at the end, a *ma* or some other nasal would have to be added on to

---

1 V. A. Smith, *Oxford History of India* (1919), p. 57.

2 *The Swastika*, by Thomas Wilson (Report of the Smithsonian Institution, 1894), p. 772.

3 Jagamanderlal Jaini, *Outlines of Jainism* (Cambridge, 1916), table facing p. 6.

4 Traditional date, which I see no reason to doubt.

5 Cf. Kielhorn in *IA*, V, p. 144.

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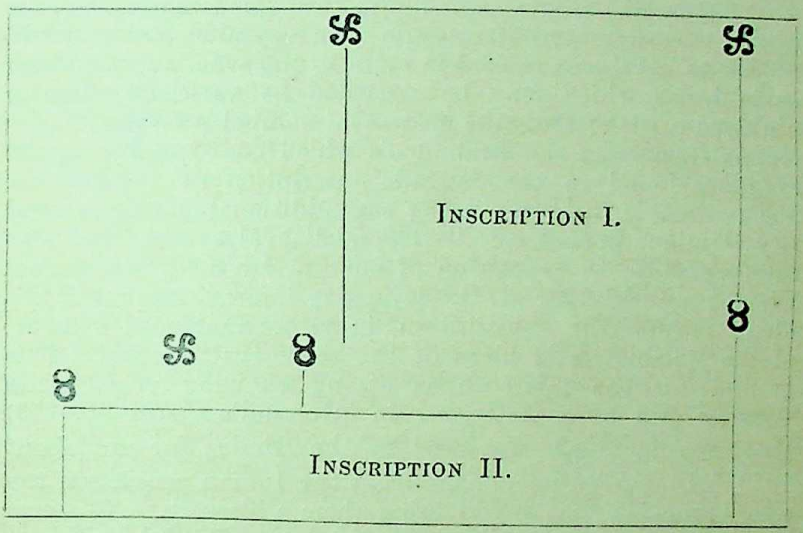
the svastika. This is exactly what we find on some of India's oldest coins upon which the svastika appears with a Brāhmī *ma* (hitherto supposed to denote the 'taurine symbol') attached to each arm.[1] *Ma* is also associated with the svastika-sign in the Jaugaḍa version of the two 'Separate Edicts' of Aśoka wherein are inscribed three svastikas with three *ma*'s as in the following diagram[2]:—



Coming down to the first century B.C., we find the svastika figuring in the records of Ushavadāta and Sātakarṇī, and the

[1] See Plate II,1, 2; Cunningham, *Coins of Ancient India*, p. 101 (D), Pl. XI, 20: other instances of svastika in company with *ma* interspersed *passim*. *Cf.* Rapson, *Coins of Andhr-as, etc.*, p. clxxv (1). *Cf.* also D'Alviella, *Migration of symbols*, p. 71, where reference is made to a coin supposed to belong to Apollonius ad Rhyndacum showing a svastika flanked by four *crescents* which recall the Indian *candra-bindu*. Even to this day, the usual Jaina practice is to place above the svastika a *candra bindu* along with three *bindus* (dots) corresponding, apparently, to the four *ma*'s of ancient coins. Association of the *candra-bindu* with the svastika is to be met with in sculpture belonging to a mediaeval Jaina cave-temple at Khandagiri wherein may be seen five panels forming a group and depicting in relievo the following figures in succession: (1) mayūra, (2) haṁsa, (3) padma, (4) svastika, (5) candra-bindu. This combination reminds us of the fact that *haṁsa* and *padma* figures in conjunction with the svastika on early Grecian vases; see Plate IV for illustrations, also discussion *infra* on the Upanishadic ideas involved in such combinations.

[2] Cunningham, *Inscriptions of Asoka*, Pl. XIII. C.'s remarks at p. 20 of this work first suggested to my mind the possibility of the svastika and the Brāhmī *ma* being together identifiable with *om*. When I communicated the idea to Sir John Woodroffe, he seemed to like it; and his attitude, I am glad to acknowledge, encouraged me to study the subject in some detail.

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same auspicious mark occurs at the beginning of many an epigraph belonging to a period not much later, sometimes in conjunction with the expression *siddham* signifying 'attainment.' In Kushān epigraphy, the svastika is rarely met with, inscriptions now generally commencing with the expression *siddham* which reminds us of the Gopatha Brāhmaṇa explanation of *om* as *sarvam-āpnoti*.

During the Gupta period, and through some subsequent centuries, inscriptions often begin with a symbol which would appear to have been related in form to the svastika. Leaving aside forms which may be regarded as variants, slightly abridged or elaborated, the mediaeval symbol exhibits shapes closely resembling the Brāhmī *o*'s which go to make up the svastikas found in the Jaugaḍa inscription of Aśoka; the one noticeable difference being the additional spiral attached to a terminus in each case.[1] The mediaeval symbol has been interpreted as an expression of oṁkāra by modern scholars who, as my friend Mr. N. G. Majumdar informs me, infer this identity from the substitution, in later analogous records, of the syllabic *om* in place of the mediaeval symbol. This ground for the inference is strong enough: it is made stronger still by a statement in Alberuni's *India* (I. 173) that 'the figure ॐ' was used by the Hindus for *om* (about 1030 A.D). Alberuni remarks that the Indian people use the sign, 'believing that it will bring them a blessing.' It seems that, even so late as Alberuni's time, the Hindus had not forgotten the relation of the 'figure' for *om* to the sign called svastika which literally means 'that which signifies well-being', 'that which brings blessings.' We may note also that mediaeval and later inscriptions often use the expression *svasti* just after *om*, and sometimes only *svasti* or only *om*. The interchangeable character of these expressions argues their identity in meaning. The fact that the svastika-sign of the earlier records gave place, in the mediaeval age, to a symbol which in form was often little else but the svastika dichotomized, followed optionally by the expression *svasti*, and which in later times bloomed forth into a syllabic oṁkāra, justifies at once the name *svastika* applied to the sign and the view that it signified nothing but the oṁkāra.

Sometimes, more often than not, the svastika-symbol appears without an accompanying *ma* or anything denoting the final nasal. This at first sight seems to go against its identification with the syllabic *om*. But if we recognize brevity to be the basis of symbolism, the difficulty vanishes. By way of illustration we may refer to the case of the sacred monogram

[1] Sometimes the symbol is little more than a spiral. [See on this point the Supplementary Note *post*.]

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Chi Rho (☧). That monogram, found on early Christian coins and figured by Constantine on his standard, represents, as is well known, the first two letters of the Greek word Χριστος, the other letters being left out to be supplied to the mind by suggestion. If five letters out of a total of seven could thus be omitted from the Christian symbol, the omission of the final *ma* of *om* from its symbolic representation in the shape of a svastika will not appear strange. From the alphabetical standpoint, the Indian symbol was simply *o*; but, symbolically, it represented the oṁkāra.

Outside India, the svastika is found dispersed on a very large scale, almost throughout the world. In England, the svastika has been known as the *fylfot*,—a word taken by the earlier etymologists to mean 'four-footed' or 'many-footed. Although the New English Dictionary challenges this derivation, I am inclined to accept it in view of the fact that the oṁkāra is described in Upanishadic literature as *catuṣpāda* or 'four-footed.'[1] The earliest undoubted occurrence of the svastika is said to be in connexion with the Third City on the site of Hissarlik, identified with ancient Troy. It is common also in the Fourth and Fifth Cities on the same site, and is principally found there on spindle whorls. Its most luxuriant expression, however, is to be met with on Grecian vases of the fifth, sixth and seventh centuries B.C.[2]

There were many varieties of the svastika already in those remote ages. I am ill-equipped to deal with all of them and with the associated emblems and figures. But some points deserve special notice here as being particularly relevant to my present thesis. The svastika-types may be classified under two broad divisions: (1) the plain svastika, 'right-handed,' and 'left handed,' and (2) the 'ogee' svastika, or svastika with spirals attached to the arms, also 'right-handed' and 'left-handed.' A most remarkable feature on a few Greek vases is the occurrence of a number of what would appear to be Greek 'M's by the side of the svastika.[3] This association of the Greek 'M's with the svastika on ancient Greek vases recalls the association of the Brāhmī *ma* with the svastika in lithic and numismatic records of ancient India, and seems to bear confirmatory testimony to the presence of a nasal element in the mystic combination. The dots which occasionally appear in conjunction with the svastika should, I think, be likewise interpreted as corresponding to the nasal *bindu* of the Indian alphabet.

---

[1] Mr. Van Manen, of the Imperial Library, although doubtful about the older etymology, admits that it is more satisfactory to the mind.
[2] Wilson, *The Swastika*. See also Plates III and IV.
[3] *Ibid.*, Figs. 27, 140, 176.

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Figures of *haṁsa* and *padma* are frequently depicted on these vases.[1] Sometimes it is a large svastika with two haṁsas on two sides accompanied by two rows of 'M'-like signs. Sometimes a conventional padma occupies the centre of the field, with two haṁsas on two sides and a number of svastikas dispersed in the field. Arrow-heads placed in échelon, obviously indicating an arrow in motion, also figure on some of these vases, sometimes in conjunction with the haṁsa and occasionally in company with the padma. On a Cyprus vase is 'represented an arrow-head, stemmed, barbed and suspended by its points between the svastika.'[2] Other animals besides the haṁsa are also depicted on the vases, such as the ram, the antelope, the horse, the lion, just as on some old Indian coins[3]; and these animals are considered by some authorities to point to the solar significance of the svastika,[4] an interpretation which has found eminent advocates armed with a goodly array of arguments.

I think it is possible and proper to explain some of these features with reference to ideas formulated in the Upanishads. Haṁsa stands there for the Brahman-Ātman. The padma reminds us of the Upanishadic notion, that the heart is shaped like the lotus (a comparison found also in the Atharvaveda) and is the abode of Brahman or even Brahman himself.[5] In Muṇḍaka, II. 2. 4, the praṇava is described as 'the bow off which the soul as the arrow flies to Brahman', and Maitr. VI. 24, represents it as 'the arrow which is shot from the body as bow in order to pierce the darkness.'[6] Perhaps, too, the horse has reference to the *aśvamedha* or horse-sacrifice with which the Bṛhadāraṇyaka Upanishad begins, 'in order to recognize in the steed the universe into which Prajāpati is transformed with the object of again offering himself in sacrifice.'[7] The presence of 'solar' animals is well accounted for by the supposition that they are counterparts of the Upanishadic conception that 'all living creatures are Brahman,'[8] and of the idea, broached even in the Aitareya Brahmana V, that the praṇava is identical with the Sun; the Chāndogya (I. 5. 1) goes so far as to represent the āditya-praṇava as making the sound *om* in its motion.

These explanations presuppose an early existence, in the Grecian world, of a system of philosophy, centering round the svastika, which was closely akin to the system of philosophy, centering round the oṁkāra, as expounded in the Upanishads. The supposition has much to support it. That ancient Greek philosophy offers many points of resemblance to anci-

---

[1] *Ibid., passim.* [2] *Ibid*, p. 850.
[3] Cunningham, *C.A.I.*, Pl. III, Nos. 1 and 2.
[4] Wilson, *op. cit.*, pp. 784–5.
[5] Deussen, *op. cit*, p. 287.
[6] *Ibid.*, p. 390. [7] *Ibid.*, p 122.
[8] *Ibid*, p. 196.

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ent Indian philosophy has long been recognized; and the receptive temperament of the early philsophers of Hellas is borne witness to by the traditional attribution of the travelling tendency to Greek philosophers like Thales and Pythagorus. Strabo, quoting from Megasthenes, notes that the opinions of Indian philosophers 'coincide with those of the Greeks on many points,' such as the nature of the soul, the origin of the world, the diffusion of the Deity through the universe.[1] Modern scholars have acknowledged the 'coincidence.' Dr. L. D. Barnett speaks of 'the singularly close parallel between Upanishadic thought and the doctrines of early Eleatic philosophers, and especially Parmenides, who may well have been contemporary with the authors of some of the most important Upanishads.... Except in his view of Being as a sphere, Parmenides is in perfect accord with the Vedānta. The similarity of Plato's doctrines is well known.'[2] Dr. Richard Garbe would go a step further and compare the theory of Thales regarding the genesis of the world from a primeval water with the similar Vedic notion.[3] The equivalence of the svastika to the oṁkāra will add to these analogies, and will appear to be particulary impressive when considered with reference to Strabo's quotation from Megasthenes alluded to above.

To the question: What was the significance of the vase-paintings? the find spots of the vases will help us to give an answer. According to Mr Walters, 'the great majority of these vases have been found in tombs, and some important discoveries have been made on the sites of temples and sanctuaries.'[4] The same scholar observes that 'vases (though not necessarily painted ones) must have played a considerable part in the religious ceremonies of the Greeks,' and further says that 'their most important use, and that to which their preservation is mainly due, was in connexion with funeral ceremonies.'[5] It will seem reasonable, therefore, to look upon the vase-paintings exhibiting the svastika-mark as possessing a religious and a spiritual significance, more specially the latter, —a view confirmed by the ancient hut urns and cinerary urns of central Italy which often bear the svastika symbol.[6] In other words, these paintings are realisations, in colour and outline, of notions pertaining to the philosophy of the Greeks which, in its earlier stages of development, could not have been divorced from their religious and spiritual notions inasmuch as even Plato who flourished in the 4th century

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[1] McCrindle, *Ancient India*, 1901, pp. 66–7.
[2] Barnett, *Brahma-Knowledge* (London, 1907), pp. 34-5.
[3] Garbe, *Philosophy of Ancient India* (Chicago, 1899), p. 33.
[4] Art. 'Ceramics' in *Encycl. Britt.*, 11th ed.
[5] *Ibid.* [6] Wilson, *op. cit*, figs. 183, 185, 186.

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B.C., is admitted by modern authorities to have fused together logic and physics, psychology, theory of knowledge and metaphysics, in a semi-religious synthesis. We have merely to recall Colebrooke's remark that 'the philosophy of India may be employed for a commentary on that of Greece' in order to perceive the entire propriety of viewing the Grecian vase-paintings in the light of the Upanishads Of the svastika in particular, as part of these paintings, we cannot urge that it is a mere design, ornamental and meaningless: its position on many of the vase-paintings violates the principle of symmetry which is otherwise discernible as being predominant in these compositions and appears to have been determined in many cases in relation to different portions of the body of the animal in association with which the sign occurs.

No doubt has been entertained in regard to the point that some of the earlier Upanishads preceded the Buddha (died 544 B.C.).[1] They attest, therefore, the existence, in India about 650 B.C.,[2] of oṁkāra worship in a highly mature form. We may speak similarly of a svastika-cult at its climax about 600 B.C. in the Hellenic world, to judge from the evidence of vases.

The earlier Greek vases represent what may be called the 'classical' phase of the svastika-cult; for the svastika often figures there as the motif of the compositions which are usually restrained, simple and majestic.[3] Later, the svastika begins to figure less prominently, but not less suggestively; the composition becomes more complex, and perhaps more fanciful, bespeaking what may be termed the 'decadent' phase.[4] Decadence has already declared itself on vases assigned to the sixth century B.C. Corresponding phases of the oṁkāra-cult may be seen in the Upanishads. In the Chāndogya, for instance, the cult appears to have passed through a distinct stage of evolution and must already have had a long history behind it. But the Māṇḍūkya betrays a pronounced development in the direction of 'decadence.' The 'decadent' stage must have commenced before the rise of Buddhism and Jainism, since many of the philosophical notions associated with oṁkāra-worship are found to form the material out of which these two religions are made. In fact, if the Upanishads, enjoining the worship of oṁkāra, represent a revolt

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1 Traditional date, adopted by Dr. Vincent Smith in his Oxford History.

2 *i.e.*, more than a hundred years before Buddha's death; cf. Rapson, *Ancient India* (Cambridge, 1916), p. 181. Some scholars incline to earlier dates. The ideas systematically put together in the Upanishads must have existed long before the Upanishads were composed, as pointed out by Mr. Hirendra Nath Dutt and other scholars.

3 *e.g. ibid.*, figs. 27, 28, 140; cf. figs. 185, 186.

4 *e.g. ibid.*, figs. 147, 162, 170, 171, 172.

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against the Vedic religion of rituals, Jainism and Buddhism should be looked upon as rebel offshoots of a religion which had, in its pursuit of knowledge and in its anxiety to maintain connexion with the older religion, attached exaggerated importance to what might with reason be regarded as a mere word, ignoring, to all intents and purposes, the practical utility of an ethical system. The flourishing period of the oṁkāra-cult in India synchronizes in this way with the flourishing period of the svastika-cult in the Grecian world. The synchronism is highly suggestive and cannot be overlooked in its relation to the identity of the svastika with the oṁkāra.

But a serious objection to the supposed sacred character of the svastika as employed by pre-historic man has been enunciated by Mr. Thomas Wilson who, after a most careful examination of the vast literature on the subject, has come to the conclusion that, since 'we find the Swastika used on small and comparatively insignificant objects, those in common use, such as vases, pots, jugs, implements, tools, household goods and utensils, objects of the toilet, ornaments, etc., and infrequently on statues, altars and the like,' 'all pretense of the holy or sacred character of the Swastika should be given up, and it should (still with these exceptions) be considered as a charm, amulet, token of good luck or good fortune, or as an ornament or decoration.'[1] I have shown above that the vases were not 'comparatively insignificant objects,' but, on the contrary, had definite religious and spiritual associations. As regards tools, implements and the Trojan spindle-whorls, the ancients may have actually worshipped them. In India it is a common practice with artisans to worship the implements or instruments which help them in their work.[2] Lastly, in the case of objects of the toilet, ornaments, etc., those of them that bear the svastika-mark may have formed part of the ceremonial 'treasures' which in olden times used to be buried with the dead,—a custom alluded to in the Chāndogya Upanishad (VIII. 8. 5) as characterizing the Asuras; or, some of them may have been votive offerings, since archæological research has proved that, amongst people affected by what is known as 'Aegean civilisation, it was a common thing to dedicate to a deity articles of personal use.

It need not be denied, however, that svastikas might, even in ancient times, make their appearance on objects unconnected with tombs or temples, the adoption of the device having been quite conceivably conditioned by a half-reverential, half-aesthetic impulse such as actuates modern men and women to adopt it on buttons and brooches. Many

[1] *Ibid.*, pp. 951-2.

[2] I am indebted to my friend Kumar Sudhindrachandra Sinhasarma for suggesting the parallel.

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originally sacred emblems have degenerated into mere ornamental designs. The sanctity of the svastika was liable to be forgotten soon in areas far away from the locality of its origin. It is a significant fact that the symbol has retained its holy association longer in India than elsewhere, except perhaps in Lapland and Finland.

The proposition that the svastika is composed of two Brāhmī *o*'s involves the assumption that the Brāhmī *o* could exist prior even to the 13th or 14th century B.C. to which date, approximately, the Trojan spindle-whorls bearing developed forms of the svastika-mark have been assigned.[1] This assumption goes against the theory, advocated by Bühler, that the Brāhmī script was derived about 800 B.C. from a Semitic source.[2] Bühler has, no doubt, succeeded in tracing a remarkable resemblance between certain letters of the ancient Semitic alphabet and old Brāhmī letters of corresponding phonetic values, e.g. in the cases of *ga* and *tha*. In many cases, however, the analogies emphasized by him seem to be too far-fetched, e.g. in *ca*, *ma* and *ya*. We must, therefore, as a recent writer remarks,[3] consider Bühler's theory unconvincing. Cunningham's theory of a hieroglyphic native origin[4] was rather summarily dismissed by Bühler on the ground that no trace has been found of the use of hieroglyphs in ancient India, and much stress was laid by Bühler on the circumstance that, in ancient times Brāhmī used to be written, like Semitic, from right to left. Professor D. R. Bhandarkar[5] has recently claimed a pre-historic origin for the Brāhmī alphabet on the strength of marks, very similar to Brāhmī letters, found on an object assigned to the 'neolithic' age, and the arguments he has advanced are by no means easy to challenge. Mr. Bhandarkar, however, has not attempted to explain the few resemblances between the Brāhmī and the Semitic scripts. Perhaps, for that attempt time is not yet. But it does not seem impossible that some Brāhmī letters are of early indigenous origin, while other letters of the alphabet may have been adopted or adapted from foreign, perhaps Semitic, originals. A tradition preserved by Alberuni[6] relates that, during the dark ages preceding the Great Civil War, the Hindus had become illiterate, and Vyāsa, the son of Parāśara, rediscovered the akṣaras by divine inspiration. The alleged rediscovery points to a deliberate attempt having been made in early times to reconstruct the lost or nearly lost script in India; and it

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1 I am not aware if this dating has been confirmed by the latest archæological researches.

2 *Indian Studies, III*, and *Indian Palaeography*.

3 *Encycl. Britt., I*, p. 732.

4 *Inscrs. of Asoka*, Pl. XXVIII.

5 *Calcutta Review*, Jan. 1920, pp. 21-39.

6 *India* (Sachau), *I*, pp. 171-2.

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may well have been the case that contemporary foreign models were consulted in this work of reconstruction. The Brāhmī script, as we find it about 500 B.C., bears in its elaboration an evident impress of the academician's hand,—a fact admitted by Bühler.[1] We do not know how much may have been due to 'the learned Brahmans' in the framing of the script. But it seems to me that they were intellectually quite equal to the task of devising, at any rate, some letters independently themselves. It is in any case manifest that the theory of a late and Semitic origin of the Brāhmī script carries with itself its own burden of proof, and that burden is as yet far from being discharged. We have no evidence, therefore, against the assignment of a sufficiently antique origin to the Brāhmī *o* which, I claim, was made the basis of the svastika symbol.

A weightier objection would be that the proposed explanation takes it for granted that the Brāhmī *o* could retain its shape unchanged during more than a thousand years (*c.* 1500-500 B.C.). Ordinarily, in the post-Aśokan period, we find a progressive palaeographic change in Indian scripts through successive centuries. The letter *o* itself has changed considerably since the days of Aśoka. Could it have remained much the same 500 B.C. as 1500 B.C.? This, I submit, is quite within the limits of possibility. As Prof. Bhandarkar[2] says; "Some of the pre-historic symbols found in Egypt and referred to a period anterior to 5000 B.C. have been found to be identical with some of the alphabetical signs of the Phoenicians, *e.g.* which have been assigned to Circa 900 B.C.—showing thus an interval of four milleniums. Coming to this country do we not find that the letter *g*, *e.g.* of the inscription on the relic-casket of the Piprahwa Stupa which may be ascribed to about 500 B.C. has survived in that exact form to this day in the modern Kanarese script?" The Brāhmī letters employed in Ceylon inscriptions in the first century B.C. are almost identical with those prevailing two or three hundred years earlier.[3] In Kharoṣṭhi palaeography, again, we do not discover, except in a few letters, any radical change between Aśoka and Kanishka. It is well-known, too, that the Tibetan script has remained stationary since the eighth century A.D., with only a few slight changes.[4] Possibly, these latter instances of stagnation illustrate the inability of scripts to grow and develop when transplanted bodily to foreign soil; but they also suffice to prove the capacity of alphabetical forms to resist, sometimes, the forces that make for change. Finally, we must bear in mind that palaeographic progress is likely to have been slower in those remote ages than in later times since the art of writing was presumably less extensively practised in the earlier

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[1] *Ind. Palaeog.* (Eng.), p. 17.
[2] *Op. cit.*, p. 35.
[3] Parker, *Ancient Ceylon*, p. 445
[4] *Ep. Ind.*, xi p. 271.

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period. It cannot, therefore, be asserted that the form of the Brāhmī *o* 1500 B.C must have been decidedly different from its form 500 B.C. In fact, it was precisely in centuries prior to 500 B.C. that oṁkāra-worship enjoyed a vigorous life, so that the letter *o* would, during those centuries, be looked upon more as a sacred emblem than as a letter and would consequently suffer little change.

That the svastika was foreign to Troy, having been introduced there about the middle of the second millenium B.C., follows directly from the circumstance that the sign is not found in the First and Second Cities on the Hissarlik site, but suddenly emerges *in a variety of forms* in the Third or 'burnt' City.[1] The question, therefore, arises: What is the link connecting 'Troy' of such an early age with the Vedic religion and its concomitant, the oṁkāra? Fortunately, Professor Winckler's discoveries at Boghaz Kuei have already supplied the link. It is now positively known that about 1400 B.C. kings with Indo-Aryan names and worshipping Vedic gods were ruling in the region of Mitanni.[2] The names *Sutarna, Dushratta*, etc., have a distinctly Indo-Aryan appearance; and it is instructive to compare the name *Gilukhipa*, borne by a daughter of Sutarna I, who was also queen of Amenophis III of Egypt (*c.* 1400 B.C.), with the name *Gurukṣepa*[3] borne, according to the Viṣṇu Purāṇa, by the third successor of Bṛhadbala of Kośala who had fallen in the Bhārata war not very many years before Amenophis.[4] Ample evidence has been secured which goes to show that there was intimate intercommunication at that period among the different peoples inhabiting Asia Minor, Egypt and the Aegean islands, so that the Vedic religion obtaining in Mitanni had many opportunities for circulation abroad. Earlier still, Mitanni had been the centre of an extensive empire, and the migration of the svastika symbol to Troy in those days is intelligible enough. The infiltration of Vedic ideas into Cyprus and other countries could not have been long delayed; and the process appears to have been reinforced later by a stream of thought represented by the earlier Upanishads. The fifteenth century B.C. thus assumes, like the sixth century B.C., a special importance from the standpoint of world-history.

Supplementary Note.

Since this paper was written, the July (1920) number of the J.R.A.S. has reached Calcutta. The number contains

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[1] Wilson, *op. cit.*, p. 810.
[2] C. H. W. Johns, *Ancient Assyria* (Cambridge, 1912), p. 54.
[3] Pargiter, *Dynasties of the Kali Age*, p. 9.
[4] The Purāṇas place the war 1015 or 1050 years before Mahāpadma who was crowned, according to my calculations based on Puranic data, 413 B.C.

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an article by Prof. Sayce on the origin of the Semitic Alphabet. According to the learned writer, the problem of the Semitic alphabet has been in a large measure solved. 'The use of the Egyptian hieroglyphs as alphabetic letters suggested to some Semitic genius the employment of them to represent the initial sounds of the Semitic words with which they corresponded..... Once the alphabet had been formed its development varied in different parts of the Semitic world'

If the Semitic alphabet was inspired by the Egyptian, the theory of a similar inspiration for the Brāhmī script comes at once into the domain of practical scientific enquiry; for, as already observed, there is in respect of certain letters, a remarkable resemblance between Brāhmī and Semitic. Could both have sprung from the same source, the Egyptian? An affirmative answer cannot at once be given: but a point supporting such an answer may be noticed. At the beginning of the present paper, reference was made to an assertion in the Aitareya Brāhmaṇa (V, 32) that Prajāpati desirous of being born as 'many' began a course of meditation resulting in the creation of three letters, *a*, *u* and *ma*, which combined produced the praṇava. We have, in this assertion, evidence of an early Indo-Aryan tradition that the letters *a*, *u* and *ma* were the first to be evolved. Naturally, the three letters would constitute a group by itself, standing apart from other and later letters. Now, this is exactly a feature of the Egyptian alphabet. As Mr. Van Manen, of the Imperial Library, points out, out of the twenty four signs in the Egyptian alphabet three and only three are pictures of birds and correspond to the three letters *a*, *u* and *m*. It is allowable to infer from this circumstance that these three letters formed a distinct group in the Egyptian alphabetical scheme. Certain scholars consider the germ of that scheme to have been conceived outside Egypt, somewhere in north-east or Central Asia. It does not seem impossible, therefore, that the so-called Egyptian alphabets were related in some measure to the alphabets of the Indo-Aryans who were at a very early period, settled in Central Asia.

This finding leads us to consider another point in regard to the Egyptian alphabetical group *a*, *u* and *m*. With the introduction of homophones in the Middle and New Kingdoms we come across a new alternative form of *u*, namely . What could this spiral represent? The spiral-ornament has been traced by Professor Goodyear to the lotus flower which occurs as a motif in Egyptian architecture as early as about the 14th century B.C. That explanation applies also, I think to the spiral-letter *u*. The spiral occurs on Trojan spindle-whorls along with its duplicated forms and [see plate II] That these forms constitute the basis of the 'ogee' svastika

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was noticed by Thomas Wilson, and I should regard them as proto-Brāhmī *ō*'s. The 'ogee' svastika was probably the earliest form of the svastika: a simplification of the spiral endings gave the forms employed in the Jaugaḍa version of Aśoka's inscriptions. The mediaeval Indian symbol, which replaces the svastika of the earlier records and is itself replaced later by the syllabic oṁkāra, should be explained in the same way. The symbol is often identical in shape with the Egyptian *u*-spiral which, to one initiated in sacred symbolism, could well recall the whole group *a*, *u* and *m*.

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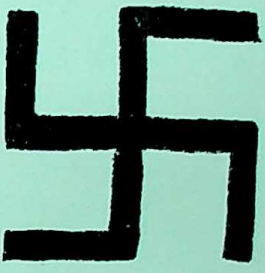
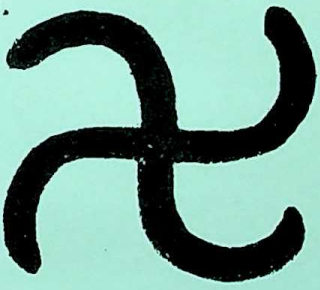
4. 

5. 

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8.

THE SVASTIKA AND THE OṀKĀRA.

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KEY TO PLATE II.

1. Brāhmī *o*, one variety.
2. Brāhmī *o*, another variety.
3. Svastika, 'left-handed.'
4. Svastika, 'right-handed.'
5. Variant of 3.
6. Variant of 4.
7. Symbol for oṁkāra, usually found in mediaeval Indian records.
8. Variant of 7, given by Alberuni.

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KEY TO PLATE III.

1. Indian Coin, Eran; reproduced from crayon copy (by Kumar S. C. Sinhasarma) of Fig. 20, Pl. XI, in Cunningham's *Coins of Ancient India.*
2. Indian Coin, Ujain; reproduced from cayon copy (by Kumar S. C. Sinhasarma) of Fig. 7, Pl. X, in Cunningham's *Coins of Ancient India.*
3. Biconical Spindle-whorl of 'Troy.'
   (Wilson, *The Swastika*, Fig. 59).
4. Spindle-whorl of 'Troy' with 'ogee' svastikas.
   (Wilson, *The Swastika*, Fig 63).

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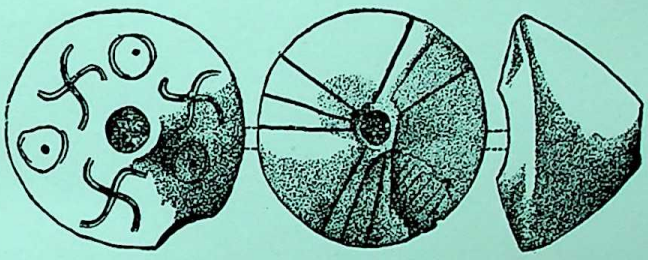

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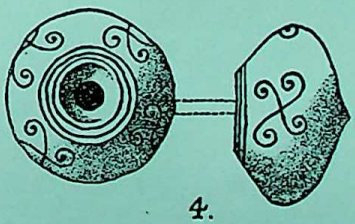

4.

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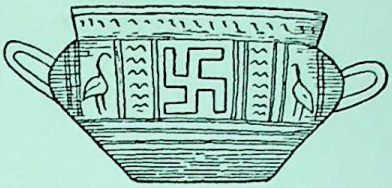

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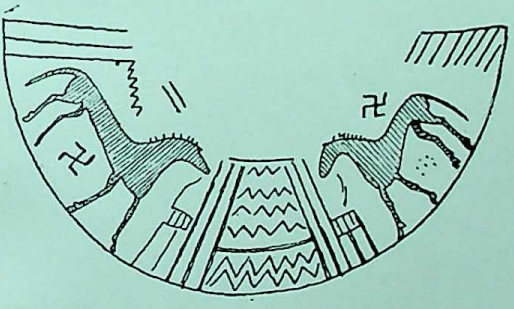

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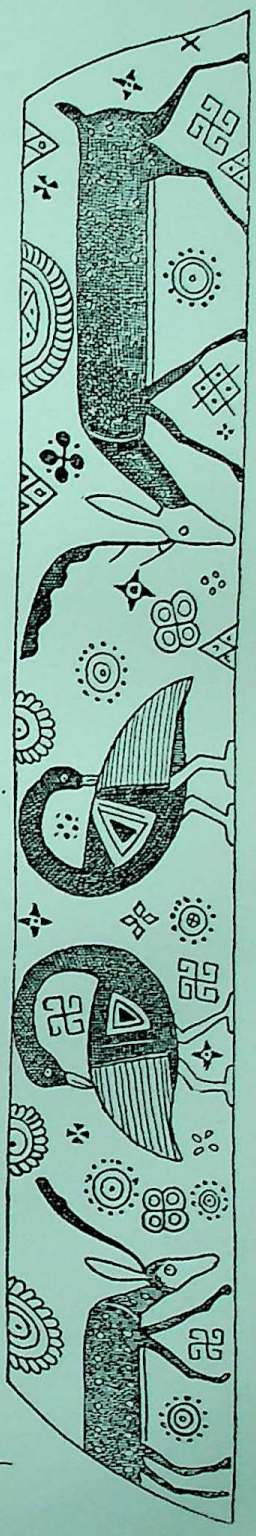

6.

THE SVASTIKA AND THE OṀKĀRA.

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KEY TO PLATE IV.

1. Greek 'Geometric' Vase (Smyrna).
   (Wilson, *The Swastika*, Fig. 140).
2. Cinerary Urn (Cervetri-Italy).
   (Wilson *The Swastika*, Fig. 186).
3. Greek Vase, oinochoe.
   (Wilson, *The Swastika*, Fig. 155).
4. Detail of Greek 'Geometric' Vase (Thera).
   (Wilson, *The Swastika*, Fig. 153).
5. Detail of Rhodian Vase.
   (Wilson, *The Swastika*, Fig. 171).
6. Detail of Greek Vase (Naukratis).
   (Wilson, *The Swastika*, Fig. 130*a*).

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9. The Successors of Kumāragupta I.

By R. C. Majumdar, M.A., Ph.D.

The discovery of the Sārnāth inscriptions of Kumāragupta and Budhagupta threw unexpected light on the history of the later Imperial Guptas and I discussed the question in a paper in the Indian Antiquary, 1918, pp. 161–167. The results of my discussion were summarised in the following Table :—

Kings.	Known Dates.	Probable Period.
1. Skandagupta *or* Puragupta or Skandagupta *and* Puragupta	A.D. 455–7, 467–8	A.D. 456–468.
2. Narasimhagupta	nil	,, 468–472.
3. Kumāragupta II	A.D. 473–4	,, 472–477.
4. Budhagupta	A.D. 477–8, 494–5	,, 478–500.

As to the relation of Skandagupta and Puragupta I observed : "On the whole, therefore, the new inscriptions seem to be fatal to the accepted view that Puragupta succeeded Skandagupta. They certainly favour the supposition that the two names were identical although they do not absolutely preclude the theory that Skandagupta and Puragupta were rival kings."

Before my article was actually published, Mr. Panna Lall dealt with the same subject in Hindusthan Review, January 1918, and practically came to the same conclusions, with this difference that he held Puragupta to be the successor of Skandagupta. Since then the question has been discussed by four different scholars. Dr. V. Smith in course of a review of Mr. Panna Lall's article endorsed his views and abandoned former theories on the subject.[1] Mr. R. D. Banerji also, in course of a long review, accepted my main conclusions, but maintained that numismatic considerations are directly against the supposition that Puragupta and Skandagupta are identical. He held that they were rival kings, "Puragupta having rebelled in Magadha during Skandagupta's absence from the capital at the time of the Hūna wars."[2]

Mr. Radhagovinda Basak, discussing the same question, arrived at totally different conclusions.[3] He held that there

[1] J.R.A.S., 1919, p. 260.
[2] Annals of the Bhandarkar Institute, Vol. I, part I, pp. 67–80.
[3] Ep. Ind., Vol. XV, p. 113.

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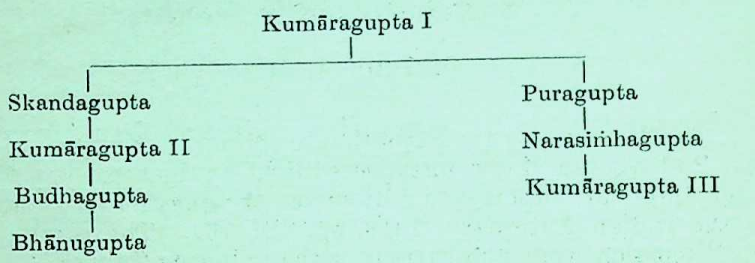
were two branches of the Gupta dynasty ruling concurrently after Kumāragupta I. His ideas on the subject are graphically represented in the following table:— [1]



Mr. N. K. Bhattasali went a step further and propounded the theory that Skandagupta, Kumāragupta II (of Sārnāth Inscription), Budhagupta and Bhānugupta ruled in an unbroken line of succession, that Puragupta succeeded Bhānugupta about 511 A.D. and was followed by his son and grandson, Narasimhagupta and Kumāragupta, who ascended the throne respectively in 515 and 530 A.D.[2]

It will thus be observed that barring the question of relationship between Puragupta and Skandagupta there is a consensus of opinion between Dr. V. Smith, Mr. R. D. Banerji, Mr. Panna Lall and myself, while the divergent views of Mr. Bhattasali and Mr. Basak are both redically different from ours.

These two scholars hold in common that the imperial Gupta line after Skandagupta ran through Kumāragupta (of the Sārnāth inscription), Budhagupta and Bhānugupta. The only evidence for accepting this Kumāragupta as the son and successor of Skandagupta is the proximity of known dates between these two kings; but as I have shown in my paper this can be easily explained in other ways. It will, I hope, be readily admitted, that we should not postulate a new line of Gupta emperors without sufficient evidence and so long as it is possible to explain otherwise all the known facts of the case. As we already know of a Gupta king named Kumāragupta, who flourished after Skandagupta, the Kumāragupta of the Sārnāth inscription must be identified with him unless there are insuperable obstacles against this supposition.

As to Mr Bhattasali's view that Puragupta succeeded Bhānugupta about 511 A.D., nothing but the strongest and the most positive evidence would incline us to believe that the son of Kumāragupta I ascended the throne more than fifty-six years after his death.

Mr. Basak's view that there were two parallel lines of

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[1] *Ibid.*, p. 120, f.n. 1.
[2] Eastern Bengal Notes and Queries Second Series No. II, pp. 50 ff.

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Gupta rulers seems at first to be more reasonable. There is, however, one difficulty which Mr. Basak himself noticed and tried to solve. "But with our present stock of knowledge," said he, "it is not very easy to indicate the place where the branch line headed by Puragupta may have ruled; for, as we shall presently show, the imperial ruler of the other branch, Budhagupta, held supremacy not only over north Bengal (Puṇḍravardhana) in the east (Plates Nos. 3 and 4) and Benares (Sārnāth image inscription No.39 E) in the middle, but also over Mālwā in the west. It has been stated before that Budhagupta's predecessor Kumāragupta II held imperial sway over the central and western provinces. It is indeed difficult to bring about a happy reconciliation between the epigraphic documents of the time of Kumāragupta II and Budhagupta and the Bhitarī seal inscription. The rulers of the branch line through Skandagupta seem to have been more powerful than those belonging to the other branch; for it will be shown that during Budhagupta's reign the Gupta power was in full height of splendour. It may be believed that the rulers of the stronger branch may, by courtesy and in good will have suffered the other branch to rule somewhere in the eastern portion of the Gupta empire, perhaps in South Bihar. . . ." [1]

The weakness of Mr. Basak's position is apparent, and even Mr. Bhattasali, who otherwise agrees with him, was unable to accept it as satisfactory. He rightly observes: "It is easy to see that this supposition does not meet the situation, and such courtesy to a branch whose origin was by revolt is, to say the least, impolitic." [2]

But Mr. Basak's position is rendered hopeless when we remember that, during the first half of the sixth century A.D., there was another dynasty of rulers who are to be located in the same area. These were the later Guptas, the founder of which, Kṛishṇagupta, almost certainly lived about 500 A.D., as king Kumāragupta, fourth in succession from him, was a contemporary of Iśānavarman and thus lived about the middle of the sixth century A.D.

The hereditary struggle of this dynasty with the Maukharis, and the inscriptions of the later kings, leave no doubt that they held Magadha in their possession. It is unfortunate that both Mr. Basak and Mr. Bhattasali have ignored their existence, for one would like to know how they reconcile their theory with the existence of the kingdom of the later Guptas of Magadha.

It will thus be observed that there is not only no sufficient evidence for the postulation of a new Gupta emperor Kumāragupta (II), upheld by Mr. Basak and Mr. Bhattasali, but that

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[1] Op. cit., p. 120. [2] Op. cit., p. 52.

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the theories of each are beset with further difficulties which have not yet been solved.

I shall now consider the other views on the subject, referred to above, which differ only as regards the relation of Puragupta and Skandagupta. Mr. Panna Lall and Dr. V. Smith think that Puragupta was the successor of Skandagupta, and offer the following chronological table :—[1]

Kumāragupta I, A.D. 414-455.

Skandagupta, A.D. 455-467	Puragupta, A.D. 467–c. 469
	Narasiṁhagupta Bālāditya, c. A.D. 469–c. 473
	Kumāragupta II, A.D. 473-477
	Budhagupta, (parentage not known) A.D. 477–c. 494

As will be seen it cramps three reigns of three generations within a period of ten years. Such a thing may not be absolutely impossible, but is certainly very unlikely, and it is chiefly on this ground that I urged in my paper that Puragupta was most probably identical with Skandagupta or a contemporary rival king.

Mr. R. D. Banerji criticises the first of these two alternative hypotheses which I put forward in my paper, from numismatic standpoint. "The fact," says he, "that on one coin the name under the left arm of the king is 'Pura' proves that this particular coin is an issue of the emperor Puragupta who is mentioned in the Bhitari seal of Kumaragupta II as the son of Kumaragupta I and the father of Narasimhagupta. This coin also proves that this prince Puragupta was quite different from Skandagupta on whose coins the name Skanda appears in the same place under the left arm of the king. In the coinage of the Imperial Gupta dynasty *there is not a single instance in which two personal names of the same emperor have been used on his coinage.* The emperor Samudragupta, Candragupta II and Kumaragupta I, all used only one proper name with a variety of titles on their coinage."[2]

Mr. Banerji evidently forgets the Kāca type of Samudragupta's coinage. Fleet,[3] V. Smith[4] and Allan have all attri-

[1] J.R.A.S., 1919, p. 262.
[2] Op. cit., pp. 73–74. The Italics are ours.
[3] C.I.I., Vol. III, p. 27.
[4] Ind. Ant., 1902, pp. 259–60.

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buted the coins bearing the name 'Kāca' to Samudragupta. According to Allan the attribution is no longer doubtful, and he believes that 'Kāca' was the original name of the emperor.[1] Whether this theory be sound or not it proves without doubt that scholars who have made a special study of the Gupta coinage are not disposed to accept the above *ipse dixit* of Mr. Banerji. Thus, so far as numismatic considerations are concerned, there is no ground for dismissing off-hand the theory that Puragupta and Skandagupta were identical, and Mr. Banerji correctly (though hardly in keeping with his statement just quoted) observes, " that there is nothing in the coinage of Puragupta or in the coinage of the Gupta dynasty which can prove anything for or against the division of the Gupta empire or the contemporaneity of Skandagupta and Puragupta."[2]

The question of the relationship between Skandagupta and Puragupta therefore still remains open. But although the coins do not help us to arrive at any solution there are certain passages in the inscriptions of Skandagupta which seem to throw some light on the complicated problem.

Thus we read in the Junāgaḍh rock inscription[3] of Skandagupta that when his father had died he had defeated his enemies and made the earth subject to himself. Again we are told that Lakshmī, meaning of course the goddess of sovereignty, selected him as her husband, having discarded the other princes. These verses seem to indicate that Skandagupta had no natural claim to the throne but obtained it by means of his own valour and prowess. This suspicion is fully confirmed by the genealogy of the Gupta emperors as given in Bihar and Bhitarī stone pillar inscriptions of Skandagupta. It mentions Chandragupta I, and his Mahādevī or chief queen, their son Samudragupta and his Mahādevī, their son Chandragupta II and his Mahādevī, their son Kumāragupta, and his son Skandagupta. The omission of the Mahādevī of Kumāragupta I, the mother of the reigning king, in striking contrast with the mention of the other Mahādevīs of earlier kings cannot but be looked upon as significant. It lends great colour to the supposition that Skandagupta was not the son of the Mahādevī or the chief queen of Kumāragupta I.

The Bhitarī seal, on the other hand, expressly mentions that Puragupta was the son of Kumāragupta and Mahādevī Anantadevi, and it may therefore be held that he was the natural heir to the throne. These circumstances easily lead to the inference that when the old emperor Kumāragupta I died after a reign of more than forty years, there ensued a struggle for succession among his sons. It was a forerunner to the

[1] Gupta Coins, p. xxxii. [2] Op. cit., p. 72.
[3] C.I.I., III, p. 56.

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story of Sha-Jahan and his quarrelling sons. The goddess of sovereignty, however, as the Junāgaḍh inscription informs us, discarded the other sons of Kumāragupta and chose Skandagupta as his overlord. In other words, Skandagupta defeated his rivals and emerged successful out of the conflict.

Then, again, we read in the Bhitarī pillar inscription that when his father had died, Skandagupta "conquered his enemies by the strength of his arms and established again the ruined fortunes of his lineage; and then, crying "the victory has been achieved", betook himself to his mother, whose eyes were full of tears from joy, just as Kṛishṇa, when he had slain his enemies, betook himself to his mother Devakī."[1] One might well ask, what is the point in the allusion to the interview between Kṛishṇa and Devakī? Is it simply the defeat and death of the enemy which preceded it that constituted the point of comparison? Or, remembering that Skandagupta's mother was not probably the chief queen, shall we go further and say that the enemy in both these cases was the rightful king, by defeating whom both Kṛishṇa and Skandagupta rescued their mother from a life of degradation? In other words, are we to suppose that Puragupta was defeated and probably killed by Skandagupta, and then the mother, who had hitherto lived an obscure life in the harem of Kumāragupta I, was suddenly raised to the position of a queen mother? Verily this might remind the poet of Kṛishṇa's slaying Kaṁsa and thereby rescuing his mother from prison and elevating her to the position of queen mother.

But whether the allusion to Kṛishṇa and Devakī may reasonably be stretched to the proposed extent or not, the indications from Junāgaḍh and Bhitarī inscriptions certainly tend to show that Puragupta was the natural heir to the throne, while Skandagupta had no legitimate claim to it. This certainly goes against the proposed identity of the two kings, and lends strength to the other alternative hypothesis, viz. that they were rival kings.

Mr. Allan concludes from an examination of the coins that the three kings Prakāśāditya, Chandragupta III and Ghatotkacagupta were not later than Narasiṁhagupta, and as the latter was the successor of Puragupta, these three probably represent the line of Skandagupta. He considers it to be at least certain that towards the end of the fifth century the Gupta line became divided in the inevitable oriental fashion.

It will be remembered that at the time when Mr. Allan wrote, the Sārnāth inscriptions were not discovered, and Skandagupta's death was placed at about 480 A.D. Now that we know that Kumāragupta II was ruling in 473 A.D., and Budhagupta in 477 A D., Mr. Allan's general conclusions can

[1] *Ibid.*, p. 55.

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no longer be upheld. But if we accept the numismatic fact observed by him, viz. that Prakāśāditya, Chandragupta III and Ghaṭotkacagupta were not later than Narasiṁhagupta and Kumāragupta II, the probability is, that these were the rival kings that set up independent rule in different parts of the Gupta empire after the death of Kumāragupta I. The inscription recently published by Mr. Garde[1] shows that Ghaṭotkacagupta was a provincial ruler under Kumāragupta I and probably his son. As to the other two kings Mr. Allan has pointed out that the style of the coins of Prakāśāditya and Chandragupta and the purity of gold of all the known specimens, suggest a date previous to the coins of Narasimhagupta and his successors. There are thus some reasons for holding that Skandagupta, Puragupta, Prakāsāditya, Chandragupta III and Ghaṭotkacagupta were the rival claimants to the throne, and this, as we have seen above, is in full agreement with the Junāgaḍh inscription of Skandagupta which tells us that the other sons of the king were discarded by Laksmī in favour of Skandagupta.

But although Skandagupta was apparently successful for the time being, it is clear that the embers of the family dissension were not finally extinguished. The line of Puragupta was revived in the persons of his son and grandson, Narasiṁhagupta and Kumāragupta II. The short reign of those kings probably indicate troubled times, but ultimately Budhagupta seems to have once more united the greater part of the Gupta empire under him. It is impossible to say at present whether his claim was based upon any relationship with Skandagupta or Kumāragupta II, but it may be noted, that after Budhagupta's time the eastern branch of the Gupta family seems to have been revived in the later Guptas.

To sum up the results so far attained: We have tried to show that the Kumāragupta of the Sārnāth inscription is the same as Kumāragupta II, the son and successor of Narasiṁhagupta, and there is no justification for assuming him to be a different person and successor of Skandagupta. Secondly, the evidence of inscription suggests that Skandagupta and Puragupta were rival kings. Thirdly, the joint evidence of inscriptions and coins indicates that there was a struggle for succession among the sons of Kumāragupta I, and Skandagupta emerged successfully out of the conflict. In conclusion, it is to be distinctly understood that the views offered in this paper are to be looked upon as tentative hypotheses, which alone are possible at the present state of our knowledge, and are merely intended as a basis for further discussion and elucidation of the subject.

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[1] Ind. Ant., 1920, p. 114.

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10. Notes on the Venous System of *Varanus bengalensis*.

By D. R. Bhattacharya, M.Sc., *Zoological Department, The Muir Central College, Allahabad, India.*

[Communicated by Dr. S. W. Kemp.]

[With plate V.]

The justification for writing this paper has arisen from the fact that *Varanus bengalensis*, being one of the fairly common big lizards of northern India, is a very suitable type for dissection, and no detailed description of its vascular system seems to exist. It may also serve to supplement the knowledge that already exists of the vascular system in *Varanus griseus*, *Varanus niloticus*, and *Varanus exanthematicus*. Beddard (and in one case Hochstetter also) has described the vascular system of the above mentioned species of *Varanus*, and since *Varanus bengalensis* differs from them in some important points of detail, a note on the above, as well as on some other points not yet noticed by the above workers may prove useful. I have dissected about a dozen fresh specimens and that precludes any idea of my having worked on a case of individual variation. I have to thank Dr. Woodland for very kindly going through and correcting the manuscript of this paper.

The Anterior Abdominal vein.—The roots of the anterior abdominal vein take their origin from the ischiadic veins of their sides, and have thus only an indirect connection with the caudal or renal portal veins (fig. 5, *r.p.v.* & *l.p.v.*). They thus conform to the condition found in other species of *Varanus* and *Heloderma*, but differ from that prevalent among the Lacertilia. They however differ from the other species of *Varanus* in one important fact that they do not give out the paired lateral abdominal veins, unless the latter may be said to be represented by a pair of very short and inconspicuous veins ending in the lateral parieties (fig. 1, *v.lat.*). The roots (pelvic veins) receive blood by a large number of veins from the fat bodies (fig. 1, *v.fat*), the ventral surface of pelvis (fig. 1, *v.w.*), from the ventral and lateral parieties and from the hind limbs. A median ventrally situated vein bringing blood from the hind limbs (fig. 1, *v.h.l.*) meets at the confluence of the roots of the abdominal vein. Anteriorly the anterior abdominal takes the usual course.

Epigastric veins.—In addition to two lateral (paired) epigastric veins (fig. 2, *r.l.epig.* and *l.l.epig.*), a third which may be called the median epigastric (fig. 2, *m.epig.*) is also

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present. These veins lie closely attached to the ventral body-wall. The lateral epigastric vein takes its origin from one of the roots (pelvic veins) fairly close to its point of junction with the corresponding vein of the other side, and enters independently into the anterior border of the liver of its side. During its course it receives branches from the fat body and lateral and ventral parieties. In this respect the lateral epigastrics resemble the condition found in *Varanus griseus*, but differ from *Varanus flavescens* (I dissected two fresh specimens) in which both the epigastrics open conjointly into the anterior border of the left lobe of the liver. What the condition may be in the other species of *Varanus*, Beddard does not give any account of. The median epigastric vein, however, arises from the ventral parieties in the region of the pelvis and in its forward course receives a short branch from the anterior abdominal vein. It receives several small branches from the ventral body-wall and lies in the median line ventrally to the anterior abdominal vein. It is not so thick and conspicuous as the lateral epigastrics. Anteriorly it bends over to the left side and joins the left lateral epigastric vein close to its termination in the liver. This vein has not been noted by Beddard in any of the species he has described.

Umbilical vein.—This vein has been described by Beddard as occurring in *Varanus niloticus* and *Varanus exanthematicus* and several other lizards. He concludes from the above that it must be a generic feature of *Varanus*, although he is himself doubtful about its presence in *V. griseus*. Its occurrence in the latter has not been noted by either Corti or Hochstetter. In spite of very careful dissection of about a dozen specimens I have not been able to find any trace of this vein in *Varanus bengalensis*.

Post caval vein.—Two efferent renal branches (venae renales revehentes—fig. 3, *v.r.v.*) from the kidney, meet at the posterior border of the dorsal lobe of the liver to form the post-caval vein (fig. 3, *p.c.v.*), which traverses the substance of the liver throughout the greater part of its length. These two efferent renals instead of ending or rather taking their origin in the substance of the kidney are continued behind the posterior edge of the kidneys and meet in the median line forming a sort of loop (fig. 3. *p.l.*). On close scrutiny it will be found that this condition is quite different from that prevailing in birds, where the branches (renal portal vein) of the caudal become directly continuous with the efferent renal veins of the post caval. A small vein (fig. 3, *v.r.*) bringing blood from the dorsal region of the rectum joins the loop posteriorly in the median line, and may be said to correspond in a way to the coccygeo-mesenteric of birds, though in this case it does not appear to join the branches of the portal vein. This splitting of post-caval into two renal

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efferents and their junction posteriorly to form a loop raises the question whether in *Varanus* this is a primitive condition or what is more possible a secondary formation owing to the great divarication of the kidneys away from the median line. Since, I have not yet got any embryological evidence, I am not in a position to put forward any opinion on the above.

Hepatic portal system.—The main trunk (fig. 4, *h.p v.*) of this system takes its origin posteriorly from two very prominent veins (fig. 5, *br.h.p.v.*) lying on the two sides of the rectum. The most interesting thing about it is that these two posterior veins take their origin directly from the posterior end of the renal portal vein, and are nearly as thick in calibre as the latter, thus establishing a direct communication between the renal portal and hepatic portal system. Such connections however, are known to exist, e.g. in some Teleosts and the Dipnoi, but the connecting veins in the latter are comparatively thinner and connect generally the caudals with the hepatic portal veins, and are not such conspicuous blood vessels as in this case.

Renal Portal vein.—The caudal vein divides into two veins. Each of these branches is continued forward into the kidneys as the renal portal vein (fig. 4, *l.r.p.v.*). Close behind the kidney the veins from the hind legs join the renal portal. Still further backwards arises the connecting vein (fig. 4, *conn.*) between the renal portal and hepatic portal vessels. The greater portion of the blood therefore is directed to the liver which is comparatively larger in this animal, through the anterior abdominal and hepatic portal veins. The kidney is supplied with blood brought mostly from the tail region and this accounts for the comparative thinness of the renal portal veins.

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EXPLANATION OF THE PLATES.

Varanus bengalensis.

FIG. 1.—Anterior abdominal and pelvic veins (nat. size). Specimen 1′1″ in length from head to base of tail. ant abd., anterior abdominal vein; *l.l.* epig. left lateral epigastric; *v.fat.*, veins from fat body; *v.h.l.*, vein from left hind limb; *v.w.*, veins from the ventral region of pelvis; *v : lat.*, vein from lateral body wall; *r.l.epig.*, right lateral epigastric vein; *r.p.v.*, right pelvic vein.

FIG. 2.—The anterior abdominal and epigastric system of veins (nat. size). Specimen 1′ in length from head to base of tail. Lettering same as in fig. 1. *r.l.*, right lobe of liver; *l.l*, left lobe of liver: *m.epig.*, median epigastric; *br.*, a branch joining the anterior abdominal with the epigastric; *v.p.*, veins from ventral parieties.

FIG. 3.—The post caval and efferent renal veins (nat. size).

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The kidneys, liver, and efferent renal veins slightly displaced. Specimen 1′ 1″ in length from head to base of tail. *l.k.*, left kidney ; *r.k.*, right kidney ; *v.r.*, vein from dorsal region of rectum. *p.l.*, posterior loop of the two efferent renals; *p.c.v.*, post caval vein; *d.r.l.*, dorsal lobe of right liver ; *v.r.v.*, right and left efferent renal veins.

Fig. 4.—The hepatic portal system and renal portal vein. (nat size). The main trunks of the veins have been displaced to show their branches. Specimen 1′ 2″ in length from head to base of tail. *r.l.*, right lobe of liver ; *qas.v.*, veins from stomach ; *pan.*, pancrease ; *spl.*, spleen ; *h.p.v.*, hepatic portal vein ; *int.v.*, intestinal veins; *ant.abd.*, anterior abdominal ; *br.h.p.v.*, branches from the sides of rectum which meet to form the main trunk of the hepatic portal system ; *l.k.*, left kidney ; *fem. v.*, femoral vein ; *caud. v.*, caudal vein ; *conn.*, connection between the renal portal and hepatic portal system of veins ; *l.r p.v.*, left renal portal vein.

Fig. 5.—The origin of the pelvic, the renal portal and hepatic portal veins (nat. size). Specimen 1′ 4″ in length from head to base of tail. The kidneys and blood vessels have been stretched outwards in order to facilitate a diagrammatic representation. Lettering same as in fig. 4, *l.p.v.*, left pelvic vein; *l.k.*, left kidney; *v.l.h.*, veins from left hind limb; *r.p.v.*, right pelvic vein ; *tr.*, transverse connection between the two posterior branches of the hepatic portal vein ; *v.v.r.*, veins from the ventral and posterior region of rectum ; *v.r.h.*, veins from right hind limb.

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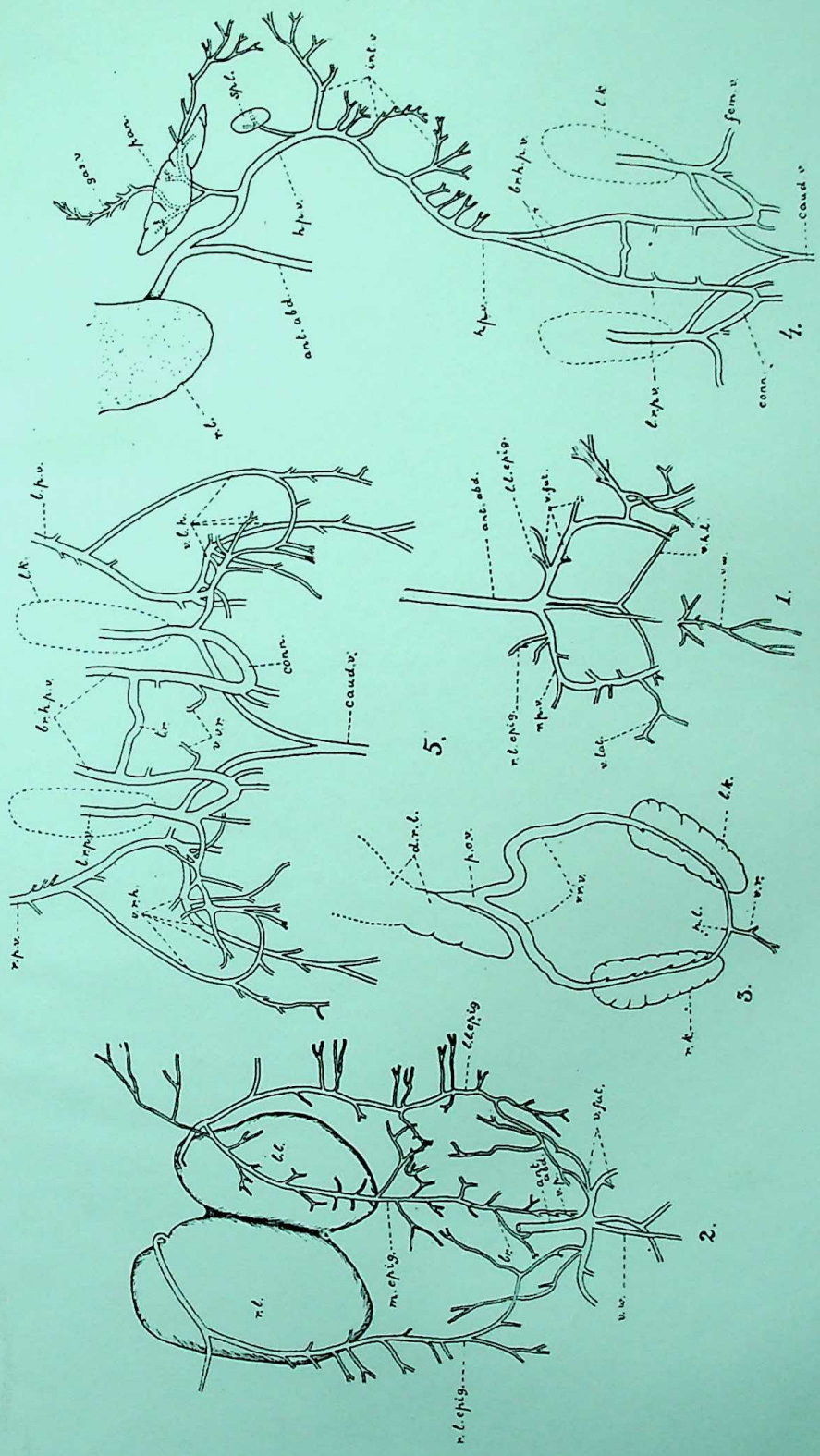

The Venous System of *Varanus bengalensis*.

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11. The Custom of Circumcision among the Dravidians.

By Muhammad Shahidullah, M.A., B.L.

The subject of circumcision has been very exhaustively treated by many eminent scholars. But it appears no one has noticed the prevalence of the custom among any Indian race or tribe. The learned writer of the article on circumcision in the *Encyclopaedia of Religion and Ethics* goes so far as to say, "It can scarcely have been practised in pre-Aryan India .... for there is no allusion to it in Sanskrit Literature." But from the *Kāmasūtra* of Vātsyāyana it appears that the practice existed among the Dravidians of his time. Let me quote here the passages :—

Dākṣiṇātyānāṃ liṅgasya karṇayoriva vyadhanaṃ bālasya 7. 2. 15.

Yuvā tu śastreṇa-cchedayitvā yāvad rudhirasyāgamanaṃ tāvad udake tiṣṭhet. 7. 2. 16.

Translation.

Among the Deccan people (the custom is) the perforation of the *liṅga*, like (that) of the two ears, (in the case) of the boy. 7. 2. 15.

But the young man having (it) cut with an instrument should stand in water as long as (there is) the coming out of blood. 7. 2. 16.

The commentator comments on this last injunction as follows :—

Chedayitvetyanena kuśalena bahiś-caıṃ-ākṛṣy-ānyatra sthāpayitvā śirāṃ tyaktvā tiryak chedayet, yathobhayataś chidraṃ bhavati. Udake tiṣṭhed rudhira-stambhanārtham.

Translation.

By the term *chedayitvā* 'having pierced' (is meant that he) should have (it) pierced slantingly leaving the blood-vessels after having, with skill, drawn the prepuce and placed it on another thing, so that there may be holes on both sides. (He) should stand in water for stopping blood.

Evidently the commentator takes the previous injunction along with this and means that only the perforation of the *liṅga* of young men is referred to. But I think that the two injunctions should be taken separately. The first (7. 2. 15.) refers to the manner of circumcision for boys which is the perforation of the prepuce, and the second (7. 2. 16.) refers to

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that for young men which is the cutting off of the prepuce. If we take both the injunctions as applying to young men, the force of *tu* (but) in *yuvā tu* will be lost. In the first injunction I take *bālasya* both with *liṅgasya* and *karṇayoḥ*. Such construction is not uncommon in Sanskrit being supported by the logic of the eye-ball of the crow which is supposed to have only one eye ball, which comes to each socket as occasion arises (*kākākṣi-golaka-nyāya*). Whatever may be the construction, it is evident from the passages quoted above that circumcision in some form or other was observed by the people of the Deccan. The use of the word '*Dākṣiṇātyānām*' (among the Deccan people) and the comparision with *karṇavedha* (the ceremony of the perforation of the ears) make it clear. It may be mentioned here that the Jewish or Muhammadan form of circumcision is not the only form of circumcision that obtains among the people who practise it, and that the Jews and the Muhammadans are not the only people who observe it.

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12. The Licchavis in Ancient India.

By Bimala Charan Law, M.A., B.L., M.R.A.S., F.R. Hist. S.

The mighty race of the Vajjians fills an important chapter in the ancient history of India. But unfortunately we know of very few historians who have up till now dealt with the subject with that thoroughness which it deserves. Their method of administration, their martial spirit, above all their nobility of character are so impressive, so inspiring and so fascinating that it is really inexplicable how they escaped the attention of eminent scholars. Their cultural history is bound to be attractive. They had eight confederate clans of which the Licchavis of Vaiśâlî were the most important. In this paper an attempt has been made to deal with some important topics relating to them.

The late Drs. V. Smith[1] and S. C. Vidyâbhûṣaṇ[2] contributed two articles on the subject to the Indian Antiquary. According to Dr. Smith, the Licchavis were Tibetans in their origin. This conclusion he supports on two grounds:—(a) the way in which they disposed of the dead, and (b) their judicial system. Dr. Vidyâbhûṣaṇ, on the other hand, holds that the Licchavis were originally Persians, they having migrated from their original home at Nisibi and settled in India and Tibet. But neither of these theories will stand the test of a through critical examination.

Mr. Hodgson holds that they were Scythians.[3] It is mentioned in the Vaijayantî that a Kṣatriya lady married to a Vrâtya brings forth a Licchavi.[4] According to the lexicographers Amarasiṁha, Halâyudha and Hemacandra, they were Kṣatriyas and Vrâtyas—sons of Kṣatriyas. Böhtlingk and Roth are of opinion that they came of a regal race. Monier Williams supports this view.[5] The Dulva states[6] that when Moggallâna entered Vaiśâlî in search of alms, the Licchavis were coming out of the city to subdue Aj̇âtaśatru. Out of veneration they asked him whether they would be successful in a campaign against Aj̇âtaśatru. Moggallâna replied, "Men of Vasiṣṭha's race, you will conquer."

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1 *Ind. Ant.* Vol. XXXII, pp. 233-236.
2 ,, ,, Vol XXXVII, pp. 78-80.
3 *Collected Essays by Hodgson* (Trübner's edition), p, 17.
4 *Vaijayantî* (Oppert), p. 76, L. 108.
5 *A Sanskrit English Dictionary* by Monier Williams, p. 902. New edition 1899.
6 *The Life of the Buddha*, by Rockhill, p. 97, Footnote.

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This proves that the Licchavis were Kṣatriyas, for we know that men of Vasiṣṭha's gotra are Kṣatriyas. It is mentioned in the *Mahâparinibbâṇa Sutta* of the *Dîghanikâya*[1] that the Licchavis claimed a portion of the relic of the august body of the Buddha as they were his castemen. It is stated there: "Bhagavā pi khattiyo, mayaṁ pi khattiyâ" (The Blessed one is a Kṣatriya, so are we.) From these two instances, we can safely come to the conclusion that the Licchavis were Kṣatriyas. This is also corroborated by the Jaina account given in the *Kalpasûtra*.[2] It is stated there that Mahâvîra was a maternal uncle of the Licchavis and they illumined the city to commemorate his death. It may be interesting to note in this connection that there was a great famine at Vaiśâlî. Buddha was invited there to check it. The chief Queen of Benares became pregnant and was delivered of a lump of flesh. To avoid a scandal, she placed it in a pot and threw it into the Ganges, the pot drifting with the current. Gods took it and wrote on it that it contained the son of the chief Queen of Benares. A hermit found the pot and kept it with him. From this lump of flesh children were born and they were known as the Licchavis.[3] This mythical account has very little historical value of its own.

As to the term Licchavi or Lecchavi, Chinese works point out that by it we understand 'Skin-thin' or 'same skin,' 'Chavi' here means 'skin'.[4] Buddhaghosa in his *Paramatthajotikâ on the Khuddaka Pâṭha*[5] splits it up into Linâchavi = Licchavi = Nicchavi. He says that things in their stomach appear to be attached to their *Chavi* or skin and hence they are called Licchavis. ("Sibbetvâ ṭhapitâ viya nesaṁ aññamaññaṁ linâ ahosi").

The young Licchavis of Vaiśālî were a free, wild set, very handsome and full of life. They dressed well and drove fast carriages.[6] Once Buddha with the Bhikkhus went out in search of alms. He addressed his followers when he saw the Licchavis on his way, "Look at the Licchavis, those who have not seen the Tâvatiṁsa gods, let them look at these Licchavis.[7] We know that the Tâvatiṁsa gods were very beautiful.[8]

It is stated in the Dulva[9] that there were continuous festivities among the Licchavis. Of them Chaṇa and Sabbarattivâro were the most important. At the Sabbarattivâro or Sabbaratticāro festival, songs were sung, trumpets, drums

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1 *Dîghanikâya* (P.T.S), Vol. II, p. 164.
2 *Kalpa Sûtra* (Jacobi), Verse 128, p. 266, S.B.E., Vol XXII.
3 *Paramatthajotikâ* (P.T.S.), pp. 158–165.
4 Watters' *Yuan Chuwang*, Vol. II, p. 77.
5 *Paramatthajotika on Khuddaka-Pâṭha* (P.T.S.), pp. 158–165.
6 Watters' *Yuan Chuwang*, Vol. II, p. 79.
7 *Mahâvastu*, ed. Senart Vol. I, p. 262.
8 *Buddhist Suttas*, (S.B.E.) Vol. XI, p. 31.
9 *The Life of the Buddha by Rockhill*, p. 63.

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and other musical instruments were used[1], flags were flown, kings, princes and commanders-in-chief took part in the festival and spent the whole night in merry-making.*

It is stated in the *Dhammapadaṭṭhakathâ* that they used to go to gardens with prostitutes (*Nagara-sobhinî*) and enjoy themselves very much.[2]

Some young Licchavis were rude in manners.[3] They loved fine arts and built many beautiful *caityas*,[4] parks and gardens.[5] It is held that they were unbelievers in the Buddha and they had their Caityas consecrated to the Yakkhas.[6] This view is incorrect. It is evident from the *Aṅguttara Nikâya*[7] that they were devoted to Buddha. When Buddha was at Vaiśâlî, 500 Licchavis worshipped him. It is stated in the *Majjhima Nikâya*[8] that some Licchavis saluted Buddha with folded hands as soon as he was seen by them. Some sat silent at a distance from the Blessed One. They were so very devoted to Buddha that they are said to have arranged a voyage for him by boat.[9]

They took delight in philosophical speculations about the non-cause of sins of beings, non-cause of the purity of beings,[10] nirvâṇa, lobha, dosa, moha, alobha, adosa and amoha.[11] They discussed among themselves problems dealing with the destruction of action, destruction of sensation, means of attaining Nirvâṇa, three kinds of sufferings, etc.[12] Abstruse metaphysical discussions relating to *sîla, Samâdhi., paññâ vimutti*, influence of the purity of *sîla* and *tapa*[13] and sublimity of *dhamma*[14] engaged their serious attention. They used also to discuss the five kinds of rare gems: *hatthiratana, Assaratana, gahapatiratana*, and *Itthiratana*.[15] Dr. B. M. Barua holds in his *Prolegomena to a study of Buddhist Philosophy*[16] that the Vajjiputtakas recognise soul and their view of Âtmâ differs from the views of Sâṅkhya and the Vedânta. The Licchavis

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1 *Saṁyutta Nikâya* (P.T.S.), Vol, I, p. 201.* *Dhammapadaṭṭhakathâ* Vol. III, p. 460. *Vajjiputtaka Bhikkhuvatthu.*
2 *Dhammapadaṭṭhakathâ* (P.T.S.), Vol III, pp. 279–280.
3 Watters' *Yuan Chwang*, Vol. II, p. 79.
4 *Aṅguttara Nikâya* (P.T.S.), Vol. IV, p. 309.
5 *The Life of the Buddha* by Rockhill, p. 63.
6 Beal's *Life of Hiuen Tsiang.* Introduction, p. xxiii.
7 *Aṅguttara Nikâya*, Vol. III, p 239.
8 *Majjhima Nikâya*, Vol. I, p. 228.
9 *Divyâvadâna*, (Cowell and Neill), pp. 55–56.
10 *Saṁyutta Nikâya*, Vol. III, pp. 68–71.
11 ,, ,, Vol. IV, pp. 261–262.
12 *Aṅguttara Nikâya*, Vol. I, pp. 220–222.
13 ,, ,, Vol. II, pp. 200–202.
14 ,, ,, Vol. III, pp. 75–78.
15 ,, ,, Vol. III, pp. 167–168.
16 Dr. B. M. Barua's *Prolegomena to a study of Buddhist Philosophy*, p. 42.

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believed in spirits. They believed in the existence of hell, especially the *Sattussadaṁ Nirayaṁ*.[1]

They were fine sportsmen and accurate archers. They used to hunt with the help of dogs[2]. They used to kill animals on the 8th, 14th and 15th day of the lunar month and eat their flesh.[3] They were rough, cruel and haughty. Some young men among them were charged with insulting girls of respectable families by throwing stones at them.[4] They had the moral courage to confess their guilt.[5]

As regards the education of the Licchavis, we know that a Licchavi named Mahâli went to Taxila to learn śilpa and returned home after completion of training. He in his turn trained many other Licchavis who took up the same work and in this way education spread far and wide among the Licchavis.

It is mentioned in the *Mahâparinibbâna Sutta of the Dîgha Nikâya* that king Ajâtaśatru of Magadha annihilated the Vajjians. Prof. Rhys Davids in his *Buddhist India*, p. 12, holds that it was some political motive which induced him to do so but the learned doctor is silent as to what those motives were. It seems that the Vajjians attacked Ajâtaśatru many times and in order to baffle their attempts (Vajjinaṁ paṭibāhāya),[6] two of his ministers, Sunidha and Vassakâra built a fort at Pâṭaligâma. It is mentioned in the Dulva[7] that a Licchavi named Mahânâman lived at Vaiśâlî who had a daughter named Amrapâlî. According to the law of Vaiśâlî a perfect woman was not allowed to marry but was reserved for the enjoyment of the people. So Amrapâlî became a courtesan. King Bimbisâra of Magadha came to know of this and himself went to Vaiśâlî for her sake although he was at war with the Licchavis. Amrapâlî had a son named Abhaya. Ajâtaśatru was under the impression that his foster brother, Abhaya, had Licchavi blood in him and he liked the Licchavis very much. At this time the Licchavis were gaining strength day by day and Ajâtaśatru thought that if Abhaya sided with them it would be very difficult for him to cope with the Licchavis. So he made up his mind to do away with them.

In the *Sumaṅgalavilâsinî*,[8] we find that there was a port near the Ganges and there was a mountain not far from it and

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1 *Petavatthu* (P.T.S.), p. 46.
2 *Anguttara Nikâya* (P.T.S.), Vol. III, pp. 75–78.
3 *Divyâvadâna* (Cowell and Neil), p. 136.
4 *Aṅguttara Nikâya*, Vol. III, pp. 75–78.
5 *Cullavagga* (S.B.E.), Vol. XX, pp. 118–125.
6 *Vajjinaṁpaṭibāhāya.* Some translate it thus—"to retard the progress of the Vajjians." The proper interpretations will be as follows—"to remove the Vajjians"; "to drive away the Vajjians."
7 The Dulva quoted in *The Life of the Buddha* by Rockhill, p. 64.
8 *Sumaṅgalavilâsinî* (Burmese Edition, Simon Hewavitarne's Bequest Series No. 1 Revised by Ñanissara), p. 99.

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at the foot of the mountain there was a mine of precious gems. Some precious gems were washed away by the Ganges, and there was a contract between the Licchavis and Ajâtaśatru that they would take the gems equally. But the avaricious Licchavis did not fulfil the agreement. This enraged Ajâtaśatru very much. He thought of punishing them for this act. He realized, however, that the Licchavis being numerically stronger, he would fail to carry out his purpose. He tried to be friendly with the Licchavis, but he had to give up this idea. At last he resorted to the device of sowing dissensions and he was not unsuccessful. Through his machinations the unity of the Licchavis was almost broken with the result that the poor Licchavis began to hate the rich and the strong looked down upon the weak. At that psychological moment Ajâtaśatru took advantage of the internal dissensions amongst the Licchavis and attacked the Vajjibhûmi. The weak Licchavis refused to stand against him and said, "Let the strong Licchavis go forward and crush him." Thus it was easy for Ajâtaśatru to conquer Vaiśâlî, the capital of the Vajjians.

If a Licchavi fell ill, the other Licchavis came to see him. The whole clan would join any auspicious ceremony performed in the house of a Licchavi. When a foreign king paid a visit to the Licchavi country, the Licchavis went out in a body to receive him and do him honour. They did not impose new taxes. Old taxes were abolished. The young Vajjians used to learn *Râjanîti* from the old experienced Vajjians. Chastity was not to be violated by force. The violation of chastity was an offence in those days. The old religious rites were observed. They used to hold frequent meetings. Matters relating to various parts of the country were heard and discussed. They sent out armies at the approach of foreign invaders. By beat of drum the meeting was announced and everyone tried to attend and having done their work they dispersed at the same time.[1]

A Licchavigaṇa could select a suitable wife for a Licchavi when asked for. It was for the Licchavigaṇa to decide cases of adultery.[2] Among the Licchavis of Vaiśâlî, there was a law to the effect that a woman born in the first district [3] could marry only in the first district and not in the second or the third. One born in the middle district could marry only in the first and the second. One born in the 3rd district could marry in any one of the three. Marriage outside Vaiśâlî was not allowed. [4]

As regards the administration of justice when a thief is

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[1] *Sumaṅgalavilâsinî*, Burmese Edition, pp. 103–105.
[2] *Bhikkhunivibhanga Sanghâdidesa*, Vol. II, p. 225.
[3] Vaiśâlî was divided into three districts.
[4] *The Life of the Buddha* by Rockhill, p. 62

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caught he is brought before the Mahâmâtto who can acquit him if he thinks him not guilty, but if he thinks him guilty he cannot inflict punishment upon him but can send him to *Vohâriko* who if he thinks that punishment is necessary sends him to *Antokâriko* who in his turn sends him to *Senâpati;* and if he is convinced of his guilt sends him to *Uparâjâ* who again sends him to *Râjâ* if he thinks him guilty. Râjâ as the highest Court of Appeal could inflict punishment upon him according to the Paveṇipotthaka, i.e. Book of Precedents.[1]

The Licchavis had a republican form of government. Râjâ was the highest Court of Appeal who alone could inflict punishment. He was elected by the people or rather by the ruling clans of the Licchavis. The administration of the country was in the hands of the Licchavigaṇa who elected their members. In the Licchavisaṁthâgâra, discussions were held on the Tîrataṇa. It is mentioned in the *Samantapâsâdikâ*[2] that the Licchavi assembly was like the assembly of gods (Tâvatiṁsadevâ). "In the assembly of the Tâvatiṁsa gods, four kings were the receivers of spoken words with regard to the matter for which the 33 gods met in the assembly and four great kings were the receivers of the admonition given".[3] From this Dr. Rhys Davids infers that the four great kings were regarded as Recorders (in their memory) of what had been said. The minutes of the meetings were kept by them. If so, there must have been such Recorders in the Mote halls of the clans.

Their relations with some ancient chiefs and tribes may be briefly noted: They were on friendly terms with king Pasenadî of Kosala as is evident from the account given in the *Aṅgulimâla Sutta of the Majjhima N.*[4] Pasenadî went to the Buddha and confessed that Bimbisara of Magadha and the Licchavis were his friends.

The Mallas and the Licchavis were not on friendly terms.

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[1] Porâṇaṁ Vajjidhamman'ti—ettha pubbe kira Vajjirâjâno ayaṁ coro' ti ânetvâ dassite, gaṇhatha taṁ coranti avatvâ *vinicchayamahâmattânaṁ* denti. Te pi vinicchinitvâ sace acoro hoti vissajjenti, sace coro hoti, attanâ kiñcî avatvâ *Vohârikânam* denti; tepi vinicchinitvâ acoro ce vissajjenti, coro ce *Suttadharâ* (different reading. Antokârikâ-Burmese manuscript) nâma honti tesaṁ denti; te pi vinicchinitvā acoroice vissajjenti, coro ce *Aṭṭhakulikânaṁ* denti te pi tath'eva katvâ Senâpatissa, Senāpati *Uparajassa*, Uparâjâ *Raññno* râjâ vinicchinitvā acoro ce vissajjeti, sace panacoro hoti "paveṇipotthakaṁ" vâcâpeti, tattha "yena idaṁ nâma kataṁ, tassa ayaṁ nâma daṇḍo'ti likhitaṁ" râjâ tassa kiriyaṁ tena samânetva tadanucchavikaṁ daṇḍaṁ karoti—iti evaṁ porâṇaṁ vajjidhammaṁ.

Sumaṅgalavilâsinî edited by Dhammakitti Siri Devamitta Mahâthera, Vol. I, p. 356. (Simon Hewavitarne Bequest Series, Colombo, 1918.)

[2] *Samantapâsâdikâ* (Burmese edition), p. 338.

[3] *The Dialogues of the Buddha*, p. 263.

[4] *Majjhima, Nikâya*, Vol. II, pp. 100–101.

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This is corroborated by the account of the fight between Bhandhula, a Mallian general and the Licchavis.[1]

It is stated in the *Cullavagga of the Vinaya Piṭaka*[2] that Vaddha, a Licchavi was instigated to bring a false charge against Dabba, a Mallian, of breach of morality, but he confessed his guilt and was punished. The Licchavis had connections with the Imperial Guptas. Chandra Gupta I married Kumârdevî, the daughter of the Licchavis.

[1] *Faüsboll's, Dhammapada*, p 219 (old edition).
[2] *S.B.E.*, Vol. XX, p. 118.

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13. Dhikoti-Karanam of Śripati.

By N. K. Majumder, M.A.

The object of the present paper is to give a brief account of the short Treatise on Practical Astronomy called "Dhikoti," a Karana-grantha of Śripati.

Present state of information.—The treatise has not yet been printed. The Calcutta University has secured a number of manuscripts of "Dhikoti" from Benares, Indore, Baroda and Madras. The present paper is based on the copy obtained from the Adyar Library in Madras, while the others are being copied for the University and have not yet been received. This copy of the manuscript in the Adyar Library has been compared with another manuscript in possession of Pd. Babuya Misra, University Lecturer, to whom I am indebted for settling a fair text by a comparison of these manuscripts.

Authorship.—The author of "Dhikoti", which is also mentioned as "Dhikotida", is, as already stated, Śripati, the renowned Indian Astronomer of the 10th Century A.D. As mentioned by Sudhakara Dvivedi in his Ganaka-Tarangini, Śripati was born in 921 Śaka or 999 A.D. In his time he was second to none. Even Bhaskaracharyya quotes from him. Śripati was not completely eclipsed by Bhaskaracharyya even in later times, for Ganesa Daivajña accepts some of his methods in preference to those of Bhaskaracharyya. From cross-references it is known that Śripati was the author of the following treatises on Mathematics, Astronomy and Astrology—

(1) Sripati-padhati, (2) Ratnavali, (3) Ratnasara,
(4) Pati-ganita, (5) Vija-ganita, (6) Dhikoti, and
(7) Siddhanta-sekhara.

Sudhakara Dvivedi expressed a regret that at least three important works of this renowned Astronomer, Śripati, namely, Pāti-ganita, Vīja-ganita, and Siddhānta-Śekhara, have been completely lost. But 7 manuscripts of Siddhanta-Sekhara have been secured for the Calcutta University, and about the same number of "Dhikoti." "Siddhanta-Sekhara" is a complete Treatise on the Theory of Astronomy in 20 chapters, whereas "Dhikoti" is merely a practical Treatise, most likely based on the "Siddhanta Sekhara."

Subject-matter.—The manuscripts of "Dhikoti" that have been obtained, show that it is a very small treatise consisting of only 20 Slokas (of 4 charanas each), and deals mainly with the practical calculation of the lunar and solar eclipses.

Date of Composition.—From what is mentioned in the 2nd

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Śloka, it is learnt that the epoch, if not the date of composition, must have been 961 Śaka (1039 A.D.). But as no peculiar phenomenon is associated with this year, as it is not divisible by 60, nor does it end in two cyphers (considerations generally influencing an Astronomer in the choice of an Epoch), it may be assumed unless any positive evidence to the contrary is forth-coming that this must also have been the date of composition. The short treatise was thus most probably composed at the ripe age of 40.

Method of Calculation.—(1) The first step is to determine the number of lunar months from 961 Śaka to the date on which we are investigating the occurrence of an eclipse. The number of solar years intervening is multiplied by 12, the number of solar months of the current year is added, thus getting the total number of solar months. This is multiplied by 2, 5 is deducted from the result, 916th part of the difference is deducted from itself, the difference is divided by 65. Then this quotient added to the number of solar months gives the number of lunar months. This is, but for a small correction, equivalent to adding two lunar months to every 65 solar months, i.e., 67 lunar months = 65 solar months.

(2) The next step is the determination of the difference in longitude of the Moon and its Node. From what is given we learn that the Moon separates from its Node in every lunar (synodic) month by 2 naksatras–18 naksatramsas (60th parts of a naksatra)—1 and 1/20 (3600th parts of a naksatra). A peculiarity of "Dhikoti" lies in the fact that the difference of the longitudes for every lunar synodic month is expressed in sexagesimals of a naksatra (13 degrees 20 minutes), and not in sexagesimals of a degree as usual. The reason will appear later. Now 2^{n}-$18^{n'}$-1 and $1/20^{n''}$ multiplied by the number of lunar months obtained before gives the total difference in longitudes of the Moon and its Node, omiting complete revolutions, for the period in Naksatramsas. Add to this the original difference in longitudes, which is given as 1-44-6. The sum will give the difference at the end of the lunar month or at Amavasya. If we want the difference for the next Purnima, we are to add further 1-9-0, i.e. half of 2-18-1 & 1/20 for half a lunar month.

(3) Then a further correction is applied according as the Sun is in one or other of the following signs :

Signs	Subtractive (naksatramsas)	Signs	Additive (naksatramsas)
Karka ..	0 3 0	Makara ..	0 6 0
Simha ..	0 8 0	Kumbha ..	0 10 0
Kanya ..	0 10 0	Mina ..	0 11 0
Tula ..	0 11 0	Mesha ..	0 10 0
Vrischika ..	0 8 0	Vrisa ..	0 6 0
Dhanu ..	0 3 0	Mithuna ..	0 0 0

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This is roughly a correction for the true place (longitude) of the Sun, and therefore also of the Moon, for, being at the end of Amavasya or Purnima, their longitudes can only differ by 0 or 180.

If the result as corrected is within 1 naksatra of either Node of the Moon, we should then proceed to the further consideration of an Eclipse, Lunar in the case of a Purnima, and Solar in the case of Amavasya. Thus 1 naksatra on either side of the Node seems to be the superior Ecliptic Limit.

(4) Next to find the latitude of the Moon. The difference of the result as obtained before, and 13^{n}-30′-0 (i.e., 180°) or 27^{n}-0-0 (i.e., 360°) as the case may be, gives the shortest distance from the nearest Node. If the result obtained in (3) is less than 13^{n}-$30^{n\prime}$-0, the latitude is North, but if it is greater than 13^{n}-$30^{n\prime}$-0 and less than 27^{n}-0-0, the latitude is South. Now the shortest distance just obtained measured in naksatras and naksatramsas (and of course less than 1 naksatra) gives the latitude if expressed in degrees, minutes and seconds. That is to say, 1 naksatra of longitude as measured from the Node corresponds to 1 degree of latitude. This is equivalent to saying that the tangent of the inclination of the Moon's Orbit to the Ecliptic is about 3/40. This is why in the first instance the difference in longitude was expressed in naksatramsas.

The latitude of the moon thus found is the latitude at the middle of the eclipse and at the end of the tithi (Amavasya or Purnima).

(5) In the case of the Lunar Eclipse the radius of the shadow at the distance of the lunar orbit is taken to be 0-38′-0″ and that of the Moon 0-18′-0″.

(*a*) Deducting from the sum 0-56′-0″ the latitude found in (4), we get the length of the portion cut off. If this is greater than 0-36′-0″ the diameter of the Moon, there will be a Total Lunar Eclipse. If the latitude is greater than 0-56′-0″, there will be no Eclipse.

(*b*) The distance travelled by the Moon relative to the Sun from the commencement of the Eclipse to the Middle of the Eclipse is equal to the square root of the difference of the squares of the sum (56′) of the radii of the Shadow and the Moon and of the Latitude of the Moon.

(*c*) The Moon travels 730′ in 60 nadikas (dandas) relative to the Sun. Thus by Rule of Three we get half the duration of the Eclipse.

(*d*) If there is a Total Eclipse, the time from the commencement of the total eclipse to the middle of the eclipse is obtained from the distance travelled by

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the Moon relative to the Sun during the time, which is equal to the square root of the difference of the squares of the difference of the radii of the Shadow and the Moon, and of the Latitude of the Moon.

(*e*) If from the time giving the end of the tithi, the time as obtained by (*c*) is deducted, we get the commencement of the eclipse ; if it is added, we get the time of the end of the eclipse. If the time as obtained by (*d*) is deducted we get the commencement of total eclipse : if it is added, we get the end of the total eclipse.

(6) In the case of the Solar Eclipse the radii of the Sun and the Moon seem to have been taken as 15′ and 18′. The process from (1) to (4) is the same as before. Then the following corrections should be introduced :—

(*a*) The time of the end of the tithi is to be corrected for Parallax in Hour Angle. The day being divided into 8 parts, the following are the corrections, subtractive in the first four parts and additive in the last four

Substractive.		Additive.	
1.	3 30 0	8.	3 30 0
2.	3 0 0	7.	3 0 0
3.	2 0 0	6.	2 0 0
4.	1 0 0	5.	1 0 0

(*b*) The latitude of the Moon as obtained in (4) is to be corrected for Parallax in Latitude. The corrections are as follows:—

Mesha and Mina ..	..	0 39′ 0″	South.
Vrisha and Kumbha	..	0 34′ 0″	,,
Mithuna and Makara	..	0 27′ 0″	,,
Karkata and Dhanu	..	0 18′ 0″	,,
Simha and Vrischika	..	0 10′ 0″	North.
Kanya and Tula ..	..	0 8′ 0″	,,

When the latitude as obtined in (4) and the parallax in latitude are both North or both South, they are to be added ; but when one is North and the other South the difference is to be taken.

I shall conclude this by a few examples. I take this opportunity of expressing my indebtedness to Prof. Ashutosh Mitra, M.A., of the Vidyasagar College for many valuable hints.

A.—Lunar Eclipse.

Example I.—To calculate if there was an eclipse at 1606 Śaka 8 months elapsed.

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Saka	1606
Deduct	961
	645
Multiply by	12
	7740
	+ 8
No. of solar months from Epoch ..	7748
Multiply by	2
	15496
Deduct	5
Difference	15491
Divide by	916
Quotient	16
Deducting from difference.. ..	15475
Dividing by	65
Quotient number of adhimasas ..	238
No. of solar months	= 7748
Number of Lunar Months	= 7748 + 238 = 7986.
Dif. in long. of the Moon and the Node in one lunation	2 18 1 & 1/20
Multiply by	7986
Total difference in Longitude 680 rev.	10 7 45
Add dif. at 961 Saka	1 44 6
Difference in Longitude on the date in question	11 51 51
As this is not within 1 naksatra of a Node, even after allowing for correction as contemplated in (3), there cannot be a Solar Eclipse.	
Add difference in lng. for a fortnight	1 9 0
Dif. in long. at end of next Purnima ..	13 0 51
Deduct, as the Sun is in Dhanu Rasi..	0 3 0
True difference in Longitude ..	12 5 51
Deducting this from 180 degrees or ..	13 30 0
Shortest distance from Node ..	0 32 9 (in naksatramsas)
Therefore Latitude North.. ..	0 32 9 (in degrees)
Deduct this from the sum of the radii of shadow & Moon	0 56 0
Cut off portion	0 23′ 51″
Diameter of the Moon	0 36′ 0″
Thus there cannot be total eclipse.	
Distance from commencement to middle of Eclipse	$=\sqrt{(0\ 56\ 0)^2-(0\ 32\ 9)^2}$ $=0\ 45'\ 51''$

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Therefore half duration	$= \frac{0\ 45'\ 51'' \times 60 \text{ nadikas}}{730'}$
	=3 nad. 46 vinad.
End of Tithi	52 nad. 0 vinad.
Thus Sparsakala (time of contact) ..	48 nad. 14 vinad.
and Moksakala (time of separation) ..	55 nad. 46 vinad.

Example II.—To calculate if there will be a lunar eclipse on 16 October, 1921 (30 Asvina, 1842 Saka elapsed).

Number of Solar Months from 961 Saka ..	10578		
Add Adhimasas	325		
Number of Lunations	10903		
Difference in long. for 10903 lun. ..	24 nak.	4	48
Add initial dif.	1	44	6
Also add for a fortnight (Purnima) ..	1	9	0
	26 nak.	57	54
Deduct for the Sun being in Kanya ..	0	10	0
	26	47	54
Deducting from 27-0-0 (i.e. 360°), Shortest distance from Node	0	12	6
Thus Latitude South..	0°	12′	6″

Thus there should be a total eclipse. And half duration = 1 hour 48 m. Modern calculation shows there will be nearly a total eclipse, ·937 part of the Moon being eclipsed, and duration = 1 hour 40 m. Thus Śripati's rules, about a thousand years old, give fairly accurate results.

B.—Solar Eclipse.

Example III.—To calculate if there was an eclipse in 1586 Saka, Magha, Vadi.

Number of Solar Months from 961 Saka	7510			
Number of Lunar Months	7740			
Dif. in Long. for 7740 lunations ..		11	15	27
Add initial dif.		1	44	6
Add for the sun being in Makara ..		0	6	0
		13	5	33
Deducting from		13	30	0
Shortest distance from Node in nakṣatras and sexagesimals ..		0-24-27		
Latitude at Middle of Eclipse, North ..		0°24′	27″	North.
Correction for Parallax in Lat. ..		0	39′	0″ South.
True Latitude		0	14′	33″ South.
Moon's Diameter		0	36′	0″
Cut off Portion		0	21′	27″

The first and the third examples are taken from the commentator.

Calcutta, 26th April, 1921.

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14. Prehistoric writing in India and Europe.

By Panchanan Mitra, M.A., F.R.A.I. *Lecturer, Calcutta University.*

The name of Piette will ever be associated with the discovery of prehistoric script in palaeolithic times, and though critics are often disposed to think that he sometimes goes too far or lays too much stress on the doubtful alphabetic value of some signs, one cannot but be struck with the soundness of his ideas. In 1896 when writing on the signs from *Mas d'Azil* he first of all pointed out clearly that such *studies pertain to the forms and not to the values of letters.*[1] "It would be wrong to think that in holding these comparisons I am dealing with the sounds which might have been represented by the signs..... Numerous modifications were introduced in the phonetic sense of the characters and we have not sufficient data which might permit us to construct the history of these transformations. The characters have also their history. In bringing forth some of those here whose antiquity is more ancient than has been thought I am putting forward materials only for such a history." Elsewhere he dwells on the pictographic and symbolic stages which were both ideographic and phonetic, from which was gradually evolved a syllabary and finally an alphabetic script.[2] But he is seen at his best in his classic essay on 'Les Écritures de l'âge glyptique,'[3] where the history of prehistoric signs is traced back to the reindeer-epoch of palaeolithic France. The examples brought forward there are not merely isolated as in the Azilian *galets* but contain two inscriptions, one from La Madeleine and the other from Rochebertier, which contain many signs of linear type placed side by side. These conclusions are thus forced upon him: "The pleistocene scripts are the most ancient which are known to us. When we find these characters, so early, should we not think that the glyptic men have left these to the assuredly later peoples, and it is the latter that have borrowed from the glyptic culture. The human groups provided with different mentalities have not matured at the same time by the formation of a script. It is this glyptic age devoted first to the fine arts that would be the first to evolve the image by simplifying it in symbol. It was endowed with

[1] Piette, Études d'ethnographie préhistorique, L'Anthropologie 1896, p. 414.
[2] Piette, Bulletins de la Société d'Anthropologie de Paris 1897, p. 285.
[3] L'Anthropologie, 1905.

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a singular aptitude for representing an object of which a part alone was figured and this faculty which though scarcely favourable to the perfecting of art was a marvellous instrument of civilisation. Through the symbol it paved the way for the script."[1] We come to know of a still earlier pleistocene script from a paper of Armand Viré three years later[2] which depicts a reindeer's horn containing no less than 22 signs of the linear type side by side. This last has been placed in the Aurignacian epoch, and the former two in the Magdalenian epoch, which, however variously estimated, cannot be brought down to later than 15000 and 8000 B.C. respectively. But what is of direct importance to us is that **no less than twelve signs in these show forms similar, if not identical, with Indian Brahmi characters.** These are, forms ' , , ,' from the *Le Madeleine* inscription (Piette, fig. 10); ' , , ,' from the Rochebertier inscription (*Piette*, fig. 11); besides '' from the Lourdes inscriptions (*Piette*, fig. 2); and , , I, , , from the stag horn baton at the Combe Cullier grotto (*Viré*, fig. 9) which I think are strikingly similar to Bráhmi (kha), (ga), (śa), (ḍa), (ta), (ṭha), (u), (ga), I (ṇa), (ta) and | (ra), respectively. It must not be forgotten here that India also had analogous stages of culture.

Any reader going through Osborn's Men of the Old Stone Age (1918) and Sollas's Ancient Hunters (2nd edition, 1915) would find that Capsian and Azilo-Tardenoision cultures, transitional between palaeolithic and neolithic, extended far to the east from the shores of France. The Vindhyan hills as well as the Banda district on the Jumna in India have been definitely recognised to be Azilian stations.[3] In the signs on **the coloured pebbles of Mas d'Azil we can recognise at least nine signs very similar to Brāhmī.** These are:— (fig. 28), (fig. 36), I (fig. 73), (fig. 75), (fig 79), (fig. 85), | (fig. 86), (fig. 93) and (fig. 94) which afford interesting comparisions with the Bráhmi (ka), (tha), I (na) (cha), (gha) (ja), | (ra) and (ba) respectively.

A comparative study of these signs in Europe has led to the discovery of interesting missing links of cultural and ethnological history in the old world. It is long since Evans brought forth his momentous discovery of pre-Phoenician script in Crete and by instituting comparisons established the affinities of the linear variety of this with the proto-Egyptian and Libyan signs. Since then the question of the origin of alphabets has attracted much attention in Europe. It is some time since Petrie started the theory 'that the linear system might not have been derived from pictographs by degenera-

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[1] L'Anthroplogie, 1905, p. 10.
[2] La Crozo de Gentillo, L'Anthropologie, 1908, pp. 421-22.
[3] Ancient Hunters, p. 529.

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tion at all but might come from ownership marks so common amongst all the primitive races."[1] In 1918, he tried to establish that the innumerable ownership-marks in Egypt in pre-dynastic and early dynastic times formed the signary from which were derived all the ancient prehistoric alphabets round the Mediterranean, but mainly the Carian and Spanish systems. I would elsewhere offer a comparative study of the ownership-marks on Indian megalithic pottery showing them to be in many cases identical with proto-Egyptian marks. Incidentally Petrie establishes that three-quarters of these signs 'are known before hieroglyphics in Egypt. It is impossible therefore to say that these signs are the decadent products of hieroglyphs; they are entirely separate in origin, though a few additions may have been made during ages of contact with hieroglyphs.'[2] The same, as we will see, was most probably the case with India also.

There are reasons to think that the invention of copper or its working on a large scale, which, as Dr. Reisener well proved, might be ascribed to Egyptians alone, (if it was not discovered by them in an earlier Central Asian home) resulted in the cultural conquest of India in proto-dynastic and pre-dynastic times. It is *at those early chalcolithic times and not later* that the megalithic idea may have spread Indiawards, for we get here almost all the pre-dolmen stages as in Egypt, and the signary of the latter, if it had influenced Indian writing, must have begun to do so in late neolithic times—as is witnessed by the script-bearing neoliths—and the two countries probably continued to be in close cultural contact till late megalithic times. In S.W. Europe also the question of the spreading of the signary found itself inextricably associated with neolithic race-movements and megalithic culture. Thus writes Mr. Adolphe Reinach in his article, *Apropos de l'origine de l'alphabet*, in *Revue épigraphique*, 1914: 'The signs painted on the galets of Mas d'Azil or incised on bones are found in the dolmens and engraved stones all over Portugal and in the writing indigenous to Spain. They belong properly to the Iberian or Ligurian populations who descend perhaps from the Neolithic invaders. On the other hand the affinity of Ligurians and Iberians with the Libyans has already shed a new light on the whole problem proving an exact analogy between the Iberians, the ancient Libyans and the modern Tifinach of Touareg."[3]

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[1] L'Anthropologie, 1915, p. 434.

[2] Scientia I-XII-1918, p. 44.

[3] The reasons may be summarily put thus:—

(*a*) Peculiar circular shaped copper axes and copper harpoons occur in India of which there are no Indian neolithic prototypes but neolithic and crude copper as well as finished forms like these occur in Egypt.

(*b*) The Dravidians are now classed by Ruggeri as H. S. Indo-africanus

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Now it should be noted here that the Basque language 'which has been connected with every outlandish language and people under the sun' has recently been claimed to be akin to the Mon Khmer language of the Santhals, Kols etc. and it has been put forward on the basis of linguistic affinities that there was a movement of peoples from the plateaus of Chhota Nagpur right up to Spain across the Red Sea, Egypt, Libya and N. W. Africa in prehistoric times. The remarkable dispersal of similar signs in prehistoric times over such an area makes us pause a little over this speculation.

We now pass on to the light task of finding Indian analogies in megalithic signs. For these Mr. Letourneau's papers though the earliest, are still the best. In dealing with some inscriptions on French megaliths called the 'Marchands' he was led to institute comparisons between them and alphabetic forms occurring elsewhere. I have got about a dozen comparative tables in my notebook from Hoerne's "Urgeschichte der bildenden Kunst" to Petrie's last in "Scientia," and as I do not find anywhere Indian signs brought in, not even in Wilke's studies in "Sudwest Europäische Megalithkultur und ihre Beziehungen zum Orient" or in the later "Kulturbeziehungen zwischen Indien, Orient und Europa," it may be presumed that it has escaped the notice of European archaeologues. **So my business here is to show that the analogies apply to India as well** though I have been content to cite everywhere only one European example. In fact at the very first glance I was struck by their Bráhmi style or rather by the neolithic or chalcolithic or megalthic style in Bráhmi as the case may be. Thus[1] sign No. 1. which occurs according to Letourneau as ᑭ and ᑲ is similar to Brahmi ᑯ (cha); sign No. 2 which occurs both as ᑕ and ᑐ is almost identical with Brahmi ᑕ (ta); sign No. 3 ᗰ resembles Brahmi ᒐ (gha); sign No. 4 ⊙ is the same as Brahmi ⊙ (tha); and the doubtful character in figure 6 which occurs as ᒣ and ᒥ is the same in form as Brahmi ᒣ (kha). What is still more surprising is that all the Marchand figures without a single exception occur almost in identical shapes in Bráhmi, the only difference at times being the reverse form which since the days of Bühler

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akin to the Ethiopians. The predynastic Egyptians were Ethiopians Bruce Foote and Morgan think also of the Early Egyptions and Dravidians as possibly akin.

(c) The dynastic people who conquered Egypt are according to Naville known as *Anu*. In Rigvedic tradition we read that the most ancient of five tribes, a '*nicht arisches Leute*' who came to India was known as *Anu*.

[1] Vide Letourneau-Les signes alphabetiformes des inscriptions megalithiques. Bulletins de la Societe d'Anthropologie de Paris, 1893.

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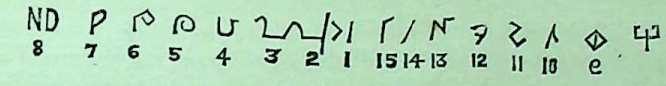
has been accepted as the more ancient Bráhmi style. Similarly all the five signs given as the Libyan signs of dolmens,[1] viz. ⊹, ⌐, ⊙, ⊓ and ◯ are easily recognised in Bráhmi as + (ka), (kha), ⊙ (tha), ⊔ ? (ba) and ◯ (tha).

The Bráhmi forms we have been so long dealing with belong to the third century B.C. It might be naturally expected that at least stray evidences such as those of our neoliths would be forthcoming showing the persistence of the linear type in India from the remotest antiquity. Thanks to the courtesy of the Archaeological department and the facilities afforded by Pandit B. K. Bidyabinode, Asst. Curator, and Prof. D. R. Bhandarkar, officer-in-charge, Indian Museum, I happened to light some time ago on a very interesting piece of pottery bearing a continuous script, which was of an archaic character. It is a very small libation cup from Bhita, bearing Catalogue No. 97 N.S. 1050, and comes from a floor level 'which could hardly be later than 8th century B.C.'[2] The letters are continuous and written round the vessel just below the slightly projecting upper ring. Some of them have disappeared through a portion having been broken off, but no less than 15 characters remain, and what is remarkable is that though a Bráhmi-like style of writing is at once evident, most of them do not approach any Bráhmi form so much as linear scripts mainly of the Mediterranean area. The letters appear thus :—



Of these sign No. 1 resembles a Bráhmi '*a*'. But it might have more nearly belonged to the class of signs represented in Hoerne's and Petrie's tables along with 'K' which appears

[1] Letonrneau-Les signes libyques des dolmens-Bull. de la Soc.d'Anthropologie de Paris, 1896, p. 320.

[2] Archaeological Survey of India, Annual Report, 1911-12, p. 37.

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as in plate Nos. F and C of fig. 15 of Mosso[1] representing stones from the primitive cells of the Pythion at Gortyna.

Sign No. 2 occurs in the Assam Neolith, is identical with 'Y' group of signs in the proto-Egyptian system and also occurs in rock-carvings near Algerian frontiers of Chhota-Tigri as is evident from (*w*) of the plate on p. 28, *L'Anthropologie*, 1916.

Sign No. 3 is almost identical with occurring on a votive-lamp found at Archanes, see fig 9 of Mosso.[2] It seems that the projection on the left is a vowel stroke.

Sign No. 4 probably belongs to the type of incomplete square signs with a vowel stroke to the right and occurs at Gortyna as figured in plate c of fig. 12 in Mosso,[3] and in p. 111*b* (pl. VIII) of Scripta Minoa.

Signs 5 and 6 are very similar and appear in a reverse form in line 3 of B of fig. 11 of Mosso.[4]

Signs Nos. 7, 8 and 9 bear strong similarities to the signs , and of the Bronze alphabetic tablets from Venetia.[5]

Sign No. 10 is also found in the linear 'A' script from the Aegean and survives in Brahmi 'ta.'

Sign No. 11 has also a long range occurring in proto-Egyptian signs as , in Caria and Spain as[6] and also in less emphasised angular forms as on the stone at Gortyna.

Sign No. 12 somewhat resembles in 'A' class inscriptions at Phaestos as in fig. 8 of Mosso.[7]

Signs 13, 14 and 15 similarly occur in the Minoan regions as in fig. 11 in Mosso[8] and have not entirely disappeared in the later Bráhmi.

In this new light of prehistoric studies the paper in Indian Antiquary, 1901, on some neolithic rock-carvings in Edakal caves, attains considerable importance, for there also we have proofs not only of Bráhmi and Minoan-like signs existing in Neolithic India but also of several characters which, though traceable outside India, are not found in the later Bráhmi system.

However incomplete and one-sided the above study may be, sufficient has been set forth to show that we have to do with a considerable Minoan element in the early chapters of Indian proto-history. And we shall have to revise our views with regard to India, as has been done in the case of Greece in recognising that the Phoenician and South-Semitic similarities

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[1] The Dawn of Mediterranean Civilisation, p. 41.
[2] Op. cit. p. 33. [3] Op. cit. p. 40.
[4] Op. cit. p. 39.
[5] Journal Royal Anthropological Institute, Vol. XLVI, p. 225.
[6] Vide Petrie's table in Scientia.
[7] Op. cit. p. 31. [8] Op. cit. p. 39.

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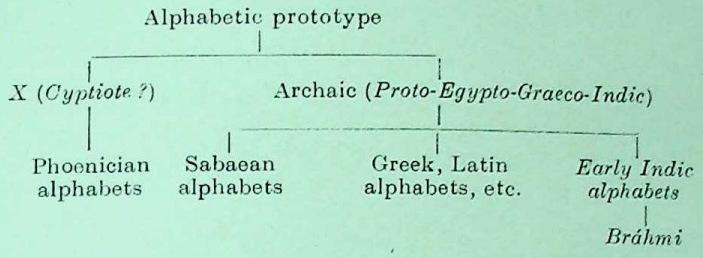
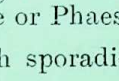
were due to their all having drawn from one common source. Thus we may accept Dussaud's table[1] for the present slightly modified (as shown by the *italics*, as possibly configuring the development of alphabets.



That the question is not so simple would be realized by finding that we have probably to recognise the remnants of a Hittite or Phaestos disc-like or a cognate hieroglyphic system in such sporadic figures as  from caves in Orissa[2] and in some of the signs of the earliest Indian seals which have already led to considerable speculation. As to whether with the Hittite language they are probably bound up with the Aryan question, is a matter about which it is too early to speak at present.

As for the proper acrophonic values of these early forms I think it would not be quite safe to say anything till we have discovered some bilingual inscription as at Caria.[3]

Besides, the linear alphabetiform character of several pre-cuneiform Sumerian signs, of some archaic Chinese signs on bones, of the Rejang alphabets in Indonesia as well as of the letters of Orkhon, Yenessi and Otarou scripts all bearing a curious family-likeness, shows the connection of this question with some prehistoric racial or cultural migrations in Asia, of which I hope to be able to offer a study at some future date.

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[1] Les Civilisations pre helleniques, 1910, p. 293.
[2] Vide Corpus Inscriptionum Indicarum, Plate XVII.
[3] Vide J.R.A.S. Jan. 1920.

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15. Three Tibetan Repartee Songs.

By Johan van Manen.

In his *Manual of Tibetan*, Major Lewin bewails the fact that with regard to Tibet, "the familiar tongue of the people, their folk-lore, songs and ballads are all unknown." This was written in 1879, almost half a century ago, and though since that date an enormous amount of new material has been published, shedding light on the most diverse problems connected with the Land of Snows, yet the statement remains true to this date. The relation between the known and the unknown is still quite disproportionate. Francke, Laufer, Marx, O'Connor and others have added to our knowledge of these matters, but of folk-lore, songs and ballads we know very little indeed. It is difficult to say what kind of lore or literature Lewin had in mind when he made his remark, but I am inclined to think that he must have thought, amongst other things, of a most remarkable expression of the Tibetan mind, the repartee song, or turn song, called གསུང་བཤད་, gsung bshad, in Tibetan. This word is not to be found in the dictionaries and without search through the literature I remember only a single reference to it in books on Tibet. This reference is to be found in Sarat Chandra Das' Tibetan Grammar, but unhappily in a form both brief and confusing. On page 60 of his Introduction to the Grammar he says: "In the repartee songs of Tibet which generally consist of verses of two lines of six syllables each, there is rhythm", and he refers to Appendix IX of Book I for the application of the remark. This appendix bears the English superscription: "The love-songs of the sixth Dalai Lama Tshang-yang Gya-tsho", and consists of three pages of Tibetan text. Unhappily the presentation is rather confused. In the first place, these love-songs are not repartee songs at all. Secondly, the text given does not consist of one piece, but of two pieces. The first portion is a reprint (with a few lines left out) of an exceedingly popular little block-print containing a selection of these love-songs, a selection which apparently leaves much to be desired from the points of view of both arrangement and method. The second portion, consisting of the last eight lines of page ३४, which are evidently also taken from songs attributed to Tshang-yang, though not contained in the little block-print, are arranged in a manner which allows of their being described as a repartee song. But

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Sarat Chandra Das does not give a separate title to this portion. The block-print alluded to was known before. E. H. C. Walsh mentions it, in his article in the J.A.S.B., Vol. LXXIII, Part I, pp. 118–177 (1904), entitled "A List of Tibetan books brought from Lhassa by the Japanese Monk, Mr. Ekai Kawa Gochi", on page 154, as No. 42, and mentions that the little work, measuring $10\frac{1}{4} \times 3$ inches as to paper and $7\frac{3}{4} \times 2$ inches as to print, with five lines to the page, can be had from any bookseller for about 4 annas. I possess half a dozen copies of it, in two different prints, all of the same size and style. The title is, as correctly given by Walsh, ཚངས་དབྱངས་རྒྱ་མཚོའི་རྣམ་ཐར་སྙན་འགྲུགས་ཀྱིས་བཀོད་པ་ཅེས་བྱ་བ་ (བཞུགས་སོ་). Sarat Chandra Das has changed the words རྣམ་ཐར་ in the title into མགུལ་གླུ་ and has left out the ཅེས་བྱ་བ་, whilst also omitting a few lines of the text. The word འགྲུགས་ is a form of སྒྲུག་པ་, to collect, which is not to be found in the dictionaries. That this little book of songs should be styled a རྣམ་ཐར་, biography or life-history, might seem strange at first sight. It is, however, explained as due to the fact that these poems are auto-biographical in nature and in their totality contain Tshang-yang's true life-story. སྙན་འགྲུགས་ stands for pleasing selection or "selection of melodiousness." This anthology is evidently based on an ampler collection, but I have not been able to ascertain the existence of a Tibetan print of such a work. None of my Tibetan friends know of any other block-print than the one we are discussing. Manuscript copies of larger collections are known, on the other hand, and I possess a little umed MS. which contains several lines not in the above edition. What is remarkable, in this connection, is that there exists a European print of such a larger collection. I possess eighteen battered and soiled pages of it, picked up in Darjeeling. No one can give me any information about it and I have never seen it mentioned in any bibliography. In my remnant the beginning and end are missing; it begins with page 7, ends with page 28, and lacks pages 19–22. It has been printed either at the Bengal Government Press in Calcutta or at its branch in Darjeeling, but on enquiry I found that both offices have no records about its production. I suppose it must have been printed there under the supervision of Sarat Chandra Das, but it seems that every trace of it has disappeared since its production. This copy has the title ཚངས་

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དབྱངས་ཀྱི་མཆོད་མཐུལ་གྱི་ at the top of its pages. It contains eight double lines of twelve syllables each on each page, every couplet being serially numbered. The first number is 46 and the last 212, but there are several mistakes in the numbering by doubling or omission of numbers. Both, block-print and type-print, have an appreciable proportion of matter in common. My umed MS., of which the orthography is deplorable, bears the title རིན་ཆེན་མཚན་དབྱངས་ཀྱི་མཆོད་གསུང་བཞད་ (བཞུགས་.) It contains 144 six-syllabled lines. I owe it to the Rev. P. O. Bodding of Dumka, who with generous courtesy made over to me this little find when he heard that I was studying Tshang-yang's poems. This much then concerning the matter of Sarat Chandra Das' Love-songs and Repartee songs. His text consists of two portions of incomplete and badly arranged lines from Tshang-yang's poems. Only careful study can enable us to re-arrange them in some consecutive and connected order. Gaps have to be filled in and many lines have to be transposed. Several poems may even prove incapable of completion with the material available. Besides, the major portion is made up of snatches of songs or perhaps even complete songs, but not as a repartee song. His last eight lines, however, constitute such a repartee song or གསུང་བཤད་. We have therefore to explain what this is. In doing so we will first discuss the word. This is defined by my friend Lama Padmacandra as meaning ལན་ཀྱག་རེས་བྱེད་པ་, to retort in turns, a verbal tit for tat, an alternation of rejoinders or repartees. It is a honorific form of the noun agreeing with the verb བཤད་པ་ཀྱག་པ་. The primary meaning of this term, however, is simply to explain. In fact the གསུང་བཤད་ is a kind of verbal tilt or joust engaged in for the sake of amusement or diversion and subject to definite conventions, a semi-poetic battle of wits, a duel with tags. It is immensely popular in Tibet. It is practised in the family circle, in gatherings, during picnics, amongst young and old. A dialogue is started in the hearing of those assembled. The original remark must have some special point in it calling for a reply. It may be a hidden taunt and then the answer may be all the more cutting. As this form of amusement is often resorted to after copious libations of chang, when the spirits are rather heated, the conversation is not always carried on in a minor key, both as to words and subjects. The amorous dialogue is much appre-

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ciated. Our samples are all three of the kind. Cleverness in allusion, and dexterity in conveying hidden meanings are greatly admired. The words used may be quotations or, though it is a rare gift to be able to do so, may be made up on the spur of the moment As a rule the sentences spoken are quotations from an immense mass of oral tradition floating about—mostly unrecorded—in the minds of the people. If an answer is not to the point the listeners declare one of the debaters vanquished. Repetition of a same line in one repartee song or even during one whole evening is a point of defeat. Non-reply, too, disqualifies. Prompters are sometimes allowed, and sometimes the actual speakers are not limited to a single pair but they wrangle in parties. A variety of the གསུང་བཤད་ is the གླུ་ཁྲལ་ in which not two people keep up a dialogue but in which each of those present is summoned in turn to recite or declaim his line or lines. On such occasions the individual called up may either choose a song, གཞས་, a story, རྣམ་ཐར་, or a hymn མགུར་མ་, or snatches from them, but the essential point is that he should be ready to declaim coherently and properly, immediately when called upon to do so. Who is silent when called up is declared defeated. It may be readily imagined that at these occasions a great deal of good-natured but rather rough and heavy banter, chaff and badinage is indulged in. When the dialogue is an amorous one it readily assumes a form of verbal horse-play. Innuendo is a great point and the old battle of the sexes is fought in all the accents of coyness, disdain, masterfulness, artfulness, coquetry or broadness in turn. Poetic and delicate feelings and similes are not absent either. Good gsung bshad experts boast of being able to keep up the contest for days without failing and without repetition. They will boast that :—

གླུ་རྙིང་རྒྱ་མཚོ་དཀྱིལ་ཡོད།
གླུ་གསར་རི་བོ་སྤུངས་ཡོད།
ད་ལྟ་ལེན་པའི་གླུ་དེ།
ཨམ་ཕག་ནང་ནས་སྟོན་ཆོག།

I have a dammed up sea of old songs.
I have a heaped up mountain of new songs.
Now I will pull out from the breast-fold of my coat.
The song in answer.[1]

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[1] For རི་བོ་ in the above verse, often རྡོ་རུག་ is said. I obtained this verse from Lama Padmacandra.

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From the above it should be clear that the discussion is held in poetry and the more telling the quotations are which are used the greater is the renown of the speaker. Tshang-yang's love-songs seem to contribute a large amount of the material for these entertainments. The last eight lines given by Sarat Chandra Das may be read as such a dialogue, though a very brief one

The gsung bshad is not exclusively amorous but often so, and naturally so amongst young people of different sex. It may, however, also be a complimentary dialogue embodying mutual courtesies and flatteries. It may even be a mystical song of a religious nature. In Milarapa's works the latter kind of dialogue is to be found. Other varieties of the gsung bshad are those in which the dialogue is meant to convey complaints, advice, admonitions or warnings to men of position or rulers present which would not be well received if told directly. Others again those in which revelations or prophecies are made. Others again express political or social satire and criticism. There are many kinds and they often afford precious information about social or political conditions of the times. New gsung bshad sayings spring up continually, and especially at Lhasa at the occasion of the annual སྨོན་ལམ་ཆོག་སྒོ་མཆོད་. The telling ones are eagerly taken up and subsequently spread through all Tibet. It is said that the new songs are always first sung by the girls who draw the water at the occasion of the above festival, the ཆུ་ལེན་མ་, who sing these songs when going about their work.

The expressions used are highly coloured, allusive and metaphorical. The gsung bshad is a source of never failing delight to the old and the young in Tibet and almost takes the place of song and music of Western countries for purposes of entertainment. In how far this amusement is specially Tibetan is difficult to say. In nature it is closely akin to the old Indian custom of debate, though this Tibetan form is always poetical. Striking points of contact and similarity, however, are suggested by the perusal of the late S. C. Vidya-bhusana's book on Indian Logic. It would be quite worth while to study these similarities closely. In Bengal there used to be a form of entertainment, now fast dying out, but still widely prevalent some half a century ago, which may be compared with the Tibetan form. It was that of the Kabirgān or Kabirladai, also called Jārigān, in which professionals held such poetic disputations for the amusement of the public.[1] The Bengal form was largely one of abuse, and

[1] At the end of this introduction I append, in the form of an addendum a few notes on this matter and on some collateral topics.

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often in Tibet, too, the dialogue is one of good-humoured but strong taunting, twitting and gibing. Spiciness in the dialogues seems to be an additional recommendation. Though broad and primitive, the Tibetan dialogue can scarcely be called obscene. In the gsung bshad nature is very natural, and spades are called spades. The Bengal custom, as I am told, still flourishes at Barisal and Bikrampur, but is on the wane. Elsewhere in India other analogies may probably be found. A more direct and a closer parallel may be found in an unexpected place, namely in Madagascar. Recently a French scholar, M. Jean Paulhan, has written a delightful essay on a sort of poetic dialogue of this nature amongst the Merinas. His essay is to be found in the Journal Asiatique for Jan.-Febr. 1912 (10th series, Vol. 19), page 133, under the title "Les Hain-teny Merinas." The same writer has elaborated his subject subsequently in a separate volume. From his descriptions it seems as if the Hain-teny is a true Malagasy gsung bshad. The points of similarity are striking. Two paragraphs from his article may be quoted as strictly applying, *mutatis mutandis*, to the Tibetan variety. It is to be noted that the element of mock-abuse provides a great part of the fun, equally in Tibet, Bengal and Madagascar. Paulhan says: "Cette récitation de hain-teny donne à l'Européen ignorant de la langue Malgache l'impression d'une querelle d'intérêts trés âpre." Recently I was present at the representation of a modern Bengali play in which one of the most delightful episodes was a clever skit on a philosophical discussion in a parishad between two mock-pandits, the grotesque stupidity of which was amusing to a degree. It seemed to me to furnish a valuable commentary on Vidyabhusana's serious book. I now quote two passages from Paulhan.

"The recitation of hain-teny has hitherto drawn only little attention of the Europeans who have dealt with Malagasy subjects. Nevertheless we should also remember our almost complete ignorance concerning the rites and dogmas of the old Merina religion. In so far as both are concerned the only Merinas whom the missionaries or explorers could interrogate were recent converts who were ashamed of their old practices and sometimes desirous to forget them themselves, but always to cause them to be forgotten. But the hain-teny is a form of light or erotic poetry; the discussion in hain-teny which is based on anything but moral principles has been regarded, by Christian Missionaries, as an 'inspiration of the devil'" (p. 138).

With a few words changed the same might be said of the Tibetan gsung bshad.

Again: "the hain-teny is essentially light poetry dealing with love. A man desires a woman and tells her so. A woman surrenders herself or refuses. A woman who has been

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abandoned complains. A man is unfaithful. A woman hesitates between two claimants. A man sings his own praises and the woman who wishes to reject him mocks him" (p. 152). This is one of the main types of the hain-teny. It is indeed remarkable to read this vivid description which could not be improved upon as an analysis of the three specimens which we give below. And Mr. Paulhan surely had never heard of the gsung bshad.[1]

It strikes me that in the light of these productions from Tibet and Madagascar perhaps some new views may be arrived at with regard to the vexed problem of the Malay pantun. But there is still another analogy which may be mentioned. It is that furnished by the songs of the Fins. There is a difference, of course, but there is also a similarity. I quote from Arthur Reade's 'Finland and the Fins' (London, 1915). In speaking of the ancient runo-singers, the author says (p. 113):—

"The songs were sung by two singers who sat opposite each other, clasped hands, and swayed forwards and backwards to the accompaniment of a harp. One sang a line, which the other repeated, thus giving the first one time to think out the next line. It is described in the opening lines of the poem [Kalevala]:—

Let us clasp our hands together;
Let us interlock our fingers;
Let us sing a cheerful measure,
Let us use our best endeavours,
While our dear ones hearken to us,
And our loved ones are instructed,
While the young are standing round us,
Of the rising generation,
Let them learn the words of magic,
And recall our songs and legends.

These my father sang aforetime,
As he carved his hatchet's handle,
And my mother taught me likewise,
As she turned around her spindle,
When upon the floor, an infant,
At her knees she saw me tumbling,
As a helpless child, milk-bearded,
As a babe with mouth all milky."

It may be objected that the Finnish song is altogether on a higher level than that of the three gsung bshad here presented.

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[1] The Merina term for the hain-teny, *ohabolana*, or word-example, is exactly the same as the Tibetan expression for proverb or maxim, གཏམ་དཔེ, gtam dpe, also word-example. Paulhan p. 2.

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but it should be borne in mind that even in the specimens given mystical and legendary elements are embedded, and secondly, that also in Finland the old stately and exalted songs have degenerated into modern flippancies and eroticisms.

In this connection I may refer to that curious dialogue between a boy and girl given by Reade on page 110, of which words and situation remind us of our gsung bshad, and we may further quote his old authority, the Meistersinger amongst runo-chanters, Arhippa Perttunnen, who said (page 31): "All through the nights they sang by the fire, hand in hand, and never the same song twice. I was a little boy and sat listening, and thus I learned my best songs. But I have already forgotten much. None of my sons will be a singer after me as I was after my father. The old songs are no longer loved as in my childhood, when they were heard at work and in idle hours in the village. Instead, the young people sing their own flippant songs, with which I wouldn't soil my lips. If at that time any one like you had looked for runos, he couldn't have written down in two weeks even those my father knew."

Another field for comparision is Nepal. I am told that there a custom still prevails which anciently was also followed in Tibet. A group of girls and boys gather together, sometimes as much as thirty in number, and a song-dialogue is started. Whoever of the two singers fails to reply suitably is declared vanquished and the victor may claim his or her company for the ensuing night. If the girl is defeated but is not comely enough to the taste of the victor he may indemnify her with a present in money without taking her home with him. This is no longer practised in Tibet, but it reminds one of the Finnish custom alluded to above as given on page 110 of Reade's book.

The three dialogues given below were dictated at my request by Mrs. Yang-dzom, the wife of one of my Tibetan teachers, Karma Samtan Paul. This good lady, who has since died, came originally from Gyangtse, and was noted in her younger years for her skill as a gsung bshad singer. It was very kind of her to consent to dictate them. I studied the first two carefully with two of my teachers and prepared a translation as well as discussed and revised the text. The third text is unrevised and I append the translation which Karma Samtan prepared for me. The language of the texts is very interesting. It is true modern Tibetan, and abounds in new words and expressions. As to the spelling of the texts the utmost reserve should be observed. I have my notes on the first two songs which fill a great number of pages foolscap, but this material cannot find a place here where only a general presentation is aimed at. Western knowledge of the Tibetan verb, and consequently of verbal orthography, is largely misleading,

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I have gained the impression that our early grammarians have started on a wrong track which has been followed ever since Csoma's Grammar. It is, however, not the occasion here to elaborate that question. Both, philologically and generally, the texts would gain in interest by full annotation and discussion but I content myself with printing the text and giving the translation in the hope to find another opportunity to publish something more detailed about them. To give an example of the debatable nature of much connected with text and translation I will mention two remarks made to me by Lama Padmacandra with whom I discussed some points before writing down this introduction. He objects strongly to the publication of the text in faulty orthography, which from the point of view of a Tibetan grammarian is valid. I point out to him, however, that we Europeans have to take texts as we find them and then must try to make the most of them. None of us are well grounded in indigenous grammar and we cannot apply canons of spelling; we have still to elaborate them. He gives as an example the word བཞེས་ in II, 6. I discussed the word in my Minor Tibetan Texts, I, (Bibl. Indica), pp. 31–32. Padmacandra says that བཞེས་ does not exist and should be བཞད་. This བཞད་, hon. གསུང་བཞད་, he says, means laughter, laugh, ཞད་མོ་. He connects it with ཁ་གསས་, for which see Jaeschke, and he seems to imply that our གསུང་བ་ཁད་ stands in reality for གསུང་་ཁ་གསས་ with the implied element of malice, taunt or ridicule as the chief value. He says that གསུང་བཞད་ is a hon. form for གླུ་, song. In this sense གསུང་བཞད་ means གསུང་བརྗོད་བ་, to burst forth in speech. But the malicious song is གླུ་ཁ་གསས་, hon. གསུང་ཁ་གསས་ He agrees that the religious song is མགུར་ or མགུར་མ་, hon. གསུང་མགུར་.

This is only an example to show how much uncertainty there is in dealing with Tibetan on the strength of what the European dictionaries give us. I may add that Padmacandra thinks rather disdainfully of the so-called "peke", the Tibetan prakrit. In nine cases out of ten, he holds, "peke" simply means that the man who writes it does not properly know grammar. In my long intercourse with him I have learned to

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give due weight to this view. Padmacandra's second remark deals with the contents of our gsung bshad, and is also of interest. He says that the appositeness of the reply is always very delicately judged and that the listeners are difficult to satisfy and ready to condemn. So, he says, for instance the second reply in I (No. 4) does not fit and would lead to the girl being declared defeated. A correct answer would be as follows :—

ཆུ་མོ་ཆུ་རིས་ཤིགས་ཤིག།
བླུང་པོའི་རྒྱུགས་ཕྱོགས་ཡིན་བག།
གསེར་བྱ་ཕྱི་ཆོམས་མ་སྐྱོན།
ཆུ་མོའི་སྟེང་ལ་འདིར་ཤོག།།

The boy covertly invites the girl to join him, in No. 3, and the answer should be : if you want me come to me :—

The ripples on the water tremble
According to the directions the wind blows.
O golden bird, don't hesitate,
Come and fly over the river.[1]

Though at a first reading the three pieces may seem uncouth and obscure they are in reality very simple. Attentive reading will soon make that clear. They are all three a lovers' quarrel ending in a reconciliation. They all end with an "and they lived happily ever after." I have added a few brief notes in elucidation of some allusions which might be obscure without them. I hope that this first case of literary collaboration of a Tibetan lady will meet with the interest it deserves.

ADDENDUM.

The chief burden of this paper is to present samples and an analysis of the Tibetan gsung bshad. The parallels are secondary. The comparison with the Malagasy variety imposed itself by the nature of its close similarity with the Tibetan form. The Finnish analogy is more a comparison 'd'estime.' The third reference, to Bengali similarities and their Indian ramifications, or extra-Indian origins, was suggested by geographical considerations. Speaking in a meeting of the Asiatic Society of Bengal such a reference seemed appropriate. To do full justice to the subject in its Bengali or other Indian bearings is, however, beyond my competence and must be left to experts. From the interesting discussion following the

[1] For བག་ in line 2 པས་ may be written; for སྐྱོན་ in line 3 གནང་ and for འཕེར་ in line 4 ཕེབས་.

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reading of my paper it was evident that the brief notes I had collected with regard to Bengal and Orissa were neither complete nor free from liability to be challenged in detail. From this same discussion it was further evident that most instructive information might be gathered and brought forward bearing on the general question of the poetic dialogue, the poetic debate, or the poetic taunt-song in North-Eastern India, and I would like to express my hope that some one of those specially qualified should do so for the benefit of us all. Subject to corrections and amplifications to be obtained in this way I now add the few notes gathered by me with regard to the subject, as a starting point for enquiry in this special direction, duly warning the reader that some points have been controverted.

My information, then, is that in Bengal there seem to be two varieties of the poetic dialogue, the one secular or profane, the other religious. The secular kind has several variations of which each has a special name, though some of these different appellations are used more or less synonymously. Mention is made of the Kabir Laḍai কবির লড়াই or poets' battle; of the Kabir Gān, poets' music; of Tarjā তরজা, or again of the Hāf-ākhḍāi হাফ-আখড়াই, "half" (*sic*) wrestling-ground or meeting-place. They all deal with Kāvya.

The religious kind deals chiefly with Pauraṇic subjects and is called Pāñcāli, পাঁচালী, "by fives."

Other varieties for which no details have been given are Jāri Gān জারি-গান, current music or, as some explain, declaration song; and Jhumur-gān ঝুমুর-গান.

It is said that the kind called Tarjā is mainly prevalent amongst the lower classes and the origin of this form is ascribed to Mohammedan influence, poetic 'prize-fights' having been instituted at the Mohammedan courts. The term itself is said to be derived from Ar. tarjī' ترجيع, repetition, burden (of a song), echo.

In the term Hāf-ākhḍai the syllable hāf is the English "half," and refers to the division of the meeting-place in two halves for the parties.

It was explained to me that pāñcāli means "by fives" and is so called because what the one leader sings is repeated by a chorus of four others. This statement, however, was controverted in the discussion at the Society's meeting. I was also told that in the pāñcāli there is only one party and that is all the other varieties given there are two parties.

Jhumur is said to be the name of a kind of music and the Jhumur-gān, explained as tinkling song, from the accompaniment of the music, is still practised amongst the lower classes in Chota Nagpur and its neighbouring tracts.

In discussing these matters with several of my Bengali friends I found no little vagueness, uncertainty and even

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contradiction, in what I was told, and I suppose that a trained folklorist or ethnographer would be needed to sift and complete the information about customs which at present seem to be disappearing and of which origins, full development and ramifications seem to be only imperfectly known. An instance of the uncertainty as to the reliability of information is furnished by the following note about Oriya customs. My informant is a well-educated gentleman in good position. Evidently what he tells me is what he, as an Oriya, knows to actually exist and happen. Nevertheless this note was criticised—in a manner both instructive and courteous—in the Society's meeting as misleading and incorrect. But now we are up before this dilemma: a man born and bred there says: this happens in my country, against which a scholar of authority maintains this does not happen so in that country. What seems to me of first rate importance in this question is that a native of the country should *think* that it happens so. We ask: why and how? So I now add the note on Orissa as I originally read it, with special emphasis on its last sentence.[1]

"My friend Mr. Paramānanda Acārya, who is an Oriya by birth and takes great interest in the literature and traditions of his country informs me that also in Orissa two forms of the same kind of dialogues are in vogue:—

One of them is customary in the so-called विवाह सभा Vivāha sabhā, marriage gathering, amongst the Brahmans in the Cuttack and Puri Districts, and takes place between the completion of the marriage ceremony and the ensuing marriage dinner. The two parties, belonging to the bride and bridegroom, arrange themselves into two groups and fight a friendly battle of quotations in Sanskrit, meant, in friendly rivalry, to establish the superior attainments of either party. The battle is fought with great determination and earnestness and forms one of the essential parts of a proper marriage feast. As in the other varieties, non-reply, or lack of suitability of the reply, disqualifies. The discussion often lasts several hours, scarcely ever less than an hour. Connected with this form of debate is also another variety called वेद पाठ, a contest in Veda recitation.

A second form of the Oriya gsung bshad is more like the Bengal pāñcāli and is called ବାଦି-ଗାୟଣ (bādi-gāyaṇa) in Oriya, quarrel-song or dispute in singing. This kind of song is sung by professionals, in two batches of about half a dozen men each, who sing in turns. Further enquiry about these matters would evidently be well worth while."

[1] My informant recently visited his native place and took special pains to verify his statements to me by local inquiry; as a result he assures me now that he is confident that his original statements were correct.

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My last note on the subject of parallels is by Mr. W. Ivanow who was so kind as to communicate to me the following valuable remarks bearing on the subject belonging to the experiences of "his" East. I am glad to add them to the other material here presented :—

"This form of poetical composition is quite common in Persia and Turkistan. You know the literary and classical forms of Munāzirah (مناظرة) for which you can refer to E. G. Browne's Literary History of Persia, Vols. I & II (especially Vol. II, where these forms of composition are discussed). Therefore I will tell you something about which you cannot find information in the literature, namely, about the popular form of the poetry composed in this way. The Persian peasantry are fond of quatrains and often one quatrain contains a question and a reply :—

1. O girl why wilt thou not go to thy relations
2. To ask about our marriage ? What dost thou say ?
3. I went to my parents and asked them.
4. They are not going to give me to thee. What dost thou say ?

Sometimes one quatrain contains a question and the next one the reply. Sometimes in two connected quatrains the question and reply follow the one after the other in each as for instance :—

I. Question 1, 2 ; reply 3, 4.
II. Question 1, 2 ; reply 3, 4, or
I. Question 1, 2 ; reply 3, 4.
II. Question 1, reply 2 ; question 3, reply 4.

The subjects are very different—love, marriage, abuse, mockery, etc., etc. I possess, for example, a fine specimen—a dialogue between a Wolf and a Shepherd.

The origin of this sort of songs (which sometimes live for hundreds of years) is chiefly improvisation. In the patriarchal life of the villagers who are not tied by the strict prescriptions of Muhammedan etiquette, the young people of both sexes freely enjoy each other's society. And often for play, at an assembly, the young talents, boys as well as girls, contest in a display of wit and invention. And in fact, under a coarse and unpolished form, one can recognise a well-shaped 'curve' of thought, and in the productions of the women one feels occasionally real feminine care and affection.

I suppose that in referring to Finnish contest-songs you think chiefly of the Kalevala, a beautiful, although somewhat shadowy, fleshless, song of the North. In this case the two singers seize each others' hands and begin to sing.

The Kurds, to return again to Eastern countries, are not so fond of the pastime but occasionally enjoy it. The Arabs, as far as I know, practise and have practised this thing in

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antiquity only for abuse. It is a common picture that two warrior-poets come in front of their respective parties, standing ready to fight, and begin a contest in verse, consisting of boasts of themselves and the nastiest insinuations against the adversary. The sides, the rank and file, take a keen interest and those whose nerves are first unable to tolerate any longer the ghastly abuse of the enemy rush first into the skirmish."

TEXT.

གུམ་སྤ་ཧར་གྱི་ཨ་ཆེ་གཡང་འཛོམས་ལགས་ནས་གསུངས་པའི་
གསུང་བཤད་ཁ་ཤས་བྲིས་པ་དགེ།།

ཁག་དང་པོ།།

1. བུ།། ལྷམ་དང་ལྷམ་ཡུ་བྲལ་ནས།
ལོ་མོ་ག་ཚོད་ལངས་སོང་།
ལྷམ་ཡུ་ཁོ་ཐག་མ་ཆོད།
བྱིན་པའི་ཉ་ལ་འཁྲིལ་བྱུང་།།

2. བོུ།། ཕུ་ཡི་གཟི་གཟི་ཁོག་སྟོང་།
ག་ལི་སྐུ་བཞུགས་གནང་དང་།
ང་ལ་ལུང་པའི་མདའ་ནས།
སྣབས་དུ་ཚི་ཚི་བརྙེད་བྱུང་།།

3. བུ།། བྱི་ཆུང་ལྕང་མའི་སྒང་གི།
ལྗ་རི་ལྗི་རི་མ་གནང་།
གསུང་བགྲོས་གསུང་རྒྱུ་ཡོད་ན།
ཚུར་ཙ་འདི་རུ་ཐོན་དང་།།

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4. བྱོ།། ལྟང་མས་ཡོམ་ཡོམ་བྱེད་པ།
འབྱུང་བ་རླུང་པོའི་འཕྲུལ་རེད།
བྱི་ཆུང་ཐུགས་གཡེང་མ་གནང་།
སྦར་རྩ་ས་ལ་ཚུགས་འདུག།

5. བུ།། ཁྱོད་རའི་ཐུགས་ལ་གང་ཡོད།
ང་ལ་ཞལ་སང་གནང་དང་།
ང་ལ་མངོན་ཤེས་པདྨའི།
ལུང་བསྟན་བཤད་རྒྱུ་མེད་དོ།།

6. བྱོ།། གཡུ་ཅིག་བརྙེས་ནི་བརྙེས་བྱུང་།
ལེགས་ལོད་ལྟ་རྒྱུ་མ་བྱུང་།
ནམ་མཁའི་བླ་མ་དཀོན་མཆོག།
གྲོ་དཀར་ཡིན་པར་ཤོག་ཅིག།

7. བུ།། གཡུ་དེ་རྒྱ་གཡུ་ཨོ་ཤེས།
བོད་གཡུ་ལམ་ལ་ཐོང་ཞིག།
རྒྱལ་ཁམས་ཆལ་མོ་ཨོ་ཤེས།
བདག་ཡོད་ལམ་ལ་ཐོང་ཞིག།

8. བྱོ།། ཁྱོད་རང་ཨ་ལག་པད་ཁོག།
ཡ་མ་ན་གི་འདུག་ན།
ང་ཡིས་ཁྱི་མགོ་སྐམ་པོའི།
རུས་པ་སྡིར་ནི་བསྟེར་གི།

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9. བུ།། གཡས་ཕྱོགས་སྟར་ཁའི་སྡོང་པོ།
གཡོན་ཕྱོགས་ཀུ་ཤུའི་སྡོང་པོ།
བྱ་ཆེན་ཨའུ་ནེ་ཙོ།
མི་ཚོ་སྐྱིད་ལ་བསྐྱལ་ཡོད།།

10. བྱོ།། ཁམ་བུ་ཟ་རྒྱུ་མེད་པས།
ཁམ་སྡོང་འབྲས་བུས་ཡོག་ཡོག།
བྱམས་པ་འཚོལ་རྒྱུ་མེད་པས།
གཏམ་གསུམ་མི་ཁས་ཡོག་ཡོག།

11. བུ།། ཕོ་ཟོམ་འཚོམ་ལ་ཕྱིན་པས།
མོ་ཟོམ་རྒྱུ་ལ་ལངས་སོང་།
ལས་ཅིག་ཡོད་ནི་ཡོད་འདྲ།
ཐང་གཞི་ཤོད་པ་མ་གནང་།།

12. བྱོ།། བྲག་གཡང་ཐོན་པོའི་རྩེ་ནས།
རི་བོང་ཀ་ཁ་ཀློག་གི།
ཆོས་ཀྱི་ཧ་གཉིས་གོ་སོང་།
ང་ནི་སྡིག་པ་མི་བསག།

13. བུ།། ཆོས་པ་བཅོ་ལྔའི་ཟླ་བ།
སྤྲིན་པས་སྒྲིབ་རྒྱུ་ཡིན་ན།
ཟླ་བའི་དཀྱིལ་གྱི་རི་བོང་།
ཚོ་ཟད་མིན་ན་གང་ཡིན།།

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14. བྱོ།། སེམས་པ་ཕར་ཤོར་མེད་པས།
ཚུར་ཤོར་ཧམ་པའི་ཆེ་ལ།
ལུས་པོ་འདྲེས་སོ་མེད་པས།
གཏན་གྲོགས་ཧམ་པའི་ཚ་ལ།།

15. བུ།། གནམ་དང་སྤྲིན་པའི་བར་གྱི།
བྱ་བཏང་ཆོས་ཉིད་རང་གྲོལ།
སྤྲིན་བཟང་དཀར་པོ་ཨོ་ཤེས།
ཆོས་ཉིད་མཐལ་ལ་ཐོང་དང་།།

16. བྱོ།། ཏ་བཟང་རླུང་གི་ཤོག་པ།
མི་བཟང་ཐང་ཀའི་ལོགས་རིས།
རླུང་གི་ཤོག་པ་མཐོང་དུས།
ཐང་ཀའི་ལོགས་རིས་དྲན་སོང་།།

17. བུ།། དཀར་ཡོལ་དཀར་སངས་གཅིག་ལ།
སེང་གེ་འོ་མ་བླུགས་ཡོད།
ནམ་མཁའི་བླ་མ་དཀོན་མཆོག།
སྣག་ཚའི་ཐིག་པ་མ་བརྒྱབ།།

18. བྱོ།། བྱ་གདང་རྒྱུག་ཕྲའི་སྟེང་གི།
བྱ་ལ་ཚོ་བརྟན་གཡུ་འབྲུག།
རང་གཉིས་ལས་ཕྲོ་ཟད་པ།
ཨ་ཀྱང་ག་ལ་དག་པ།།

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ཁག་གཉིས་པ ༎

1. སྐྱེས ༎ བྱམས་པ་འགས་ལ་ཚེ་གང་།
གཏན་གྲོགས་གནང་དང་མ་ཞུས།
ཞག་གསུམ་ཕ་མ་དྲན་པས།
སྐྱོ་རོགས་གནང་དང་ཞུས་ཡོད༎

2. ཁྱོ ༎ དམར་པོའི་མེ་ཅིག་ཁུར་ཤོག།
ཞིམ་པོའི་ཐ་མག་འཐུང་གི།
གདན་ཆུང་གྲུ་བཞི་ཁུར་ཤོག།
བསམ་བློ་གཞི་མ་བཏང་གི།

3. སྐྱེས ༎ གང་ཟག་ཅིག་གི་གྱོད་ལ།
འཇག་མའི་སྐེད་པ་ཆག་སོང་།
ཁྱོད་ལ་ལྷོ་རོང་སྨྱུག་མའི།
གདེང་ཚོད་རྙེད་པ་མིན་ནམ༎

4. ཁྱོ ༎ ཐ་མག་གང་མགོ་གང་ལ།
ཆུང་འདྲིས་བཀའ་སྐྱོན་མ་གནང་།
སྐྱོ་པོའི་བྱང་ཐང་འགྲིམ་དུས།
ཆུང་འདྲིས་ལགས་ལས་ལྷག་པས༎

5. སྐྱེས ༎ ཕུ་ཡི་སྲིད་པའི་གངས་རི།
འགྱུར་མེད་གནས་ཆེན་གངས་བཟང་།

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ཆུ་ལ་རྒྱུན་ཆད་མི་འདུག།
ངང་སྟོད་གསེར་གཞོང་རིང་མོ།།

6. ཁྱོ།། གསུང་ལ་སྙན་པ་ཅིག་གི།
གསུང་ལའི་བཞེས་ཤིག་བཞེས་དང་།
པདྨ་བཀའ་ཐང་ཀློག་པའི།
ཀློག་མདངས་ཡ་ལས་སྙན་པས།།

7. སྐྱེས།། གྲེ་བ་འདི་ལ་ཕན་པའི།
དྭངས་ལའི་ཆུ་ཅིག་བྱུང་ན།
གླུ་ཆུང་རིག་པས་སྤྱད་ནས།
ག་ནས་བཏང་བཏང་ཡིན་ནོ།།

8. ཁྱོ།། སེར་གདུབ་ལྟགས་འདྲེས་ཟངས་འདྲེས།
ཡང་ཏིག་བྱམས་པའི་སྐུ་དྲིན།
རྒྱུ་འདོད་བློ་ལ་ཡོད་ཀྱང་།
གཏམ་ཐག་ཚིག་གིས་བཀག་སོང་།།

9. སྐྱེས།། སེར་གདུབ་གཡུ་ཕྲས་བསྐོར་ན།
ད་ལྟ་སྐོར་ཉག་འདུག་གོ།
དེ་མིན་གཡུ་ཆུང་གྲོ་དཀར།
ཡུན་རིང་གནས་ས་མ་རེད།།

10. ཁྱོ།། མཚོ་སྟོད་ཡ་རུ་བཀག་མགོ།
རྡོ་རང་འདྲ་ཅིག་རྒྱབ་ཡོད།

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མཚོ་སྨད་ཉ་ཆུང་གསེར་མིག།
མིག་ཆུ་ཁྲུལ་ལེ་ལུས་སོང་ ॥

11. སྐྱེས ॥ མཚོ་སྟོད་བཀག་མགོ་བསྒྱུར་བ།
མཚོ་སྨད་ཉ་མོས་མ་ཤེས།
ཤིང་སྡོང་ཁོག་པ་རུལ་བ།
ཨ་ཆེ་བྱ་ཁྲས་མ་ཤེས ॥

12. ཁྱོ ॥ རྒྱ་མཚོའི་མཐའ་ལ་ཕྱིན་པས།
མུ་ཏིག་འཕྲེང་བ་བརྙེད་བྱུང་།
གསེར་གྱི་མདུད་འཛིན་མེད་པས།
མུ་ཏིག་འཕྲེང་བས་གང་བྱེད ॥

13. སྐྱེས ॥ པང་གདན་ཁྲ་ཆུང་འོག་གི།
ལན་ཆགས་ཕྲུ་གུ་མགོ་ནག།
སྡེར་བཞི་འཁྲབ་འཁྲབ་མ་བྱེད།
ཨ་ཕ་འཚོལ་དགོས་ཡོད་དོ ॥

14. ཁྱོ ॥ ལྕང་གླིང་མིག་གིས་མཐོང་དུས།
ཟས་ལ་ཟ་འདོད་མ་བྱུང་།
བྱི་ཆུང་ཡིད་ལ་འཁོར་དུས།
མཚན་མོའི་གཉིད་ཐེབས་བཅག་བྱུང་ ॥

15. སྐྱེས ॥ རྟ་བཟང་འགྲོས་དང་མཐུན་སོང་།
མི་བཟང་ལ་མོ་བརྒྱབ་སོང་།

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སྤྱན་མིག་སྒྲི་སྒ་ཤིག་ཤིག།
ད་ཚོད་ག་པ་ཡོད་དམ།།

16. སྐྱེས།། ཆར་པ་བབས་ཅིག་བབས་གཉིས།
གྲ་ཕྱི་ཐང་ལ་མ་བབས།
ཞལ་ངོ་དཀོན་མཆོག་ལགས་ཀྱི།
དབུ་ཞྭའི་ཚོན་མདོག་ལོག་ཡོང་།།

17. སྐྱེས།། ཆུང་འདྲིས་ལ་མོའི་ཕར་ཕྱོགས།
ང་རང་ལ་མོའི་ཚུར་ཕྱོགས།
ལས་དང་སྐལ་བ་ཡོད་ན།
ལ་མོའི་རྩེ་རུ་འཛོམས་ཤོག།

18. སྐྱེས།། བྱ་གཅིག་གནམ་ལ་འཕིར་བའི།
འདབ་ཆགས་སྐྱ་ཀ་ཁྲ་ཆུང་།
བུ་མོའི་གྲ་ཕྱིའི་ཐང་ལ།
ལན་དང་འཕྲིན་པ་སྣོམས་དང་།།

19. སྐྱེས།། སེམས་ལ་སེམས་པའི་སྡུག་བསྔལ།
འདུག་གོ་གསུང་རོགས་གནང་དང་།
ལུས་ལ་སྙུང་གཞི་མགུལ་ཆམ།
མི་འདུག་གསུང་རོགས་གནང་དང་།།

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།བཀ་གསུམ་པ།།

1. སྐྱེས།། ཅ་མི་འི་རི་དེ་སྦྱང་གཤོང་བདེ་མོ་འདུ།
ཇོ་ལགས་སྲས་ཆུང་སྦྱང་བརྒྱན་མེ་དོག་འདུ།
སྦྱང་བརྒྱན་མེ་དོག་སྦྱང་གི་ལོག་ལ་བཞུགས།
བྱ་མོ་བསོད་ནེད་ངང་ཡུལ་ཕྱོགས་ལ་འགྲོ།།

2. སྐྱེས།། གཟིར་ཆུང་ཤོག་ཁྲའི་ནང་ལ་ཞག་གཅིག་ཅལ།
སྲས་ཆུང་བློ་ཡི་མ་ཐོང་ཞག་གཅིས་ཅལ།
དུ་བའི་ཁྲེ་མིག་གཡར་དང་ཆིབས་དཔོན་ལགས།
བསམ་འགྱུབ་ཟག་པ་བདེན་དགོས་ཆིབས་དཔོན་ལགས།།

3. སྐྱེས།། དུ་ལ་ལྕ་བཅུ་ཐམ་པ་སྦྲུད་པ་ཡིན།
སྦྱང་གསུམ་སྦྲུད་པའི་ལིང་གཤང་རྒྱབ་གི་ཡིན།
རྒྱ་མཆོ་ས་ཐག་རིང་ལ་ས་རོང་རྩྭ།
དུ་ལ་དར་ཁ་སྐྱོན་དང་ཆིབས་དཔོན་ལགས།།

4. སྐྱེས།། གལ་ལི་བཞུགས་ཤིག་ཞུས་པས།
གལ་ལི་ཕེབས་ཤིག་གསུངས་སོང་།
གལ་ལི་གལ་ཞུག་ལས་སོང་།
མཆི་མས་གཡས་བསྐོར་རྒྱབ་སོང་།།

5. ཁྱོ།། ཆུ་མོ་ཐང་ཤིག་ཐང་ཤིག།
ཉིན་མཚན་མེད་པ་ཐང་ཤིག།

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ཉ་མོ་ང་རའི་བློ་གཏད།
རྡོ་རྗེ་བྲག་ལ་བཅོལ་ཡོང་།།

6. སྐྱེས།། མི་གཉོབ་རྟིང་ཀ་བསྟེག་ན།
ལྷམ་གི་ཟ་ཁ་བྲལ་ཡོང་།
མི་མཐོང་རྒྱངས་མིག་ལྟས་ན།
མིག་གི་མིག་ཙ་བྲལ་ཡོང་།།

7. ཁྱོ།། ཨ་ཤེལ་ལགས་ཀྱི་ཁོག་པ།
རྡོ་ཤེལ་ལགས་ཀྱིས་རྒྱང་འདུག།
གཡུ་ཆུང་བྲོ་ཁའི་ཁོག་པ།
གཏུང་སྐུད་དམར་པོས་རྒྱང་འདུག།

8. སྐྱེས།། དཀར་ཡོལ་དམར་ཁྲ་འདྲ་པོ།
ལྷ་སའི་ཁྲོམ་ལ་འདུག་ཞུས།
དྲིན་ཆེན་ཕ་མ་འདྲ་པོ།
ལྷ་སའི་ཁྲོམ་ལ་མི་འདུག།

9. ཁྱོ།། མི་ཚོས་ཟེར་བར་ལྟ་ན།
ས་གཞི་ཡོམ་ཡོམ་བྱས་ཡོང་།
ང་རང་པདྨའི་གདན་ལ།
འགྱུར་བ་མེད་པ་སྡད་ཡོད།།

10. སྐྱེས།། དགའ་པོ་ཤིག་ཙམ་བྱས་པས།
མི་ཁ་གཡག་ཙམ་བསྒྲགས་སོང་།

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ཤ་འཇམ་ལུས་པོ་འདྲེས་སོང་།
ག་རེ་གནང་རྒྱུ་ཡོད་དམ།།

11. ཁྱོ།། དཀར་པོ་བྱེ་མའི་དཀྱིལ་གི།
ནག་པོ་སྡིག་པ་རྣ་ཛ།
ལྕགས་ཀྱི་ལྷམ་ཆུང་གོན་ནས།
བསྒྲད་བསྒྲད་གཏོང་ལ་ཕེབས་ཤིག།

12. སྐྱེས།། ཆར་པ་གནམ་ནས་བབ་པར།
མ་བབ་ཞུ་རྒྱུ་མི་འདུག།
འོག་ཆུའི་འོག་གི་ཐིག་པ།
མི་བཟེད་ཐག་ཆོད་ཡིན་ནོ།།

13. ཁྱོ།། ཤ་སིང་རི་དྭགས་དཀྱིལ་ལ།
བུ་མོ་རི་བོང་འདྲ་མོ།
དགོས་པའི་ཞུ་གུ་མི་འདུག།
མི་དགོས་ཨམ་མཆོག་རིང་བ།།

14. སྐྱེས།། སྟག་ལ་ལ་མོ་འི་རྩེ་རུ།
སྙན་པོ་ཚིག་གསུམ་གཏང་པས།
རི་བོ་ས་རྡོ་ཡིན་ཀྱང་།
དབུ་ལ་ཇོག་ཇོག་གནང་སོང་།།

15. ཁྱོ།། ཏ་ཕོ་གཟིང་ཏ་མ་རེད།
གཟིང་ཏ་འགྲོས་མ་མ་རེད།

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ཁྱོད་རང་འགྲོགས་མགོ་མ་གནང་།
འཐུང་མགོ་གཡོག་མཁན་མི་འདུག།

16. སྐྱེས།། སྟག་ལ་ཕ་གཞིས་མ་རེད།
ཨར་ཕོ་བརྟན་ཆགས་མ་རེད།
ཟུར་བཞི་ལྷ་ཁང་བཞེངས་ནས།
རང་ཡུལ་ཕྱོགས་ལ་ལོག་འགྲོ།

17. ཁྱོ།། སྔར་སོང་སྟག་ལའི་ལ་ལ།
ལྷ་ཁང་ཡོད་པ་མ་ཤེས།
ད་ཆ་སྟག་ལའི་ལ་ལ།
སྤྲུལ་པའི་ལྷ་ཁང་བཞེངས་འདུག།

18. སྐྱེས།། སྟག་ལའི་ལ་རུ་བཞུགས་པའི།
དབུ་ལ་རྣམ་པ་ལྷན་རྒྱས།
བུ་མོའི་ངོ་ལ་མ་གཟིགས།
བརྩིགས་པའི་ཟུར་ལ་གཟིགས་ཤིག།

19. ཁྱོ།། སེམས་པ་སྐྱོ་དང་མ་སྐྱོ།
ད་ལོའི་ལོ་ལས་སྐྱོ་བ།
ང་རང་སྐྱོ་བས་མ་ཆོག།
ནམ་མཁའི་བྱ་ཡང་སྐྱོ་སོང་།།

20. སྐྱེས།། ཐུགས་སེམས་སྐྱོ་སྐྱོ་མ་གནང་།
རི་བཟང་རྨུག་པའི་སྲས་པོ།

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རྨུག་པ་ཡལ་དང་བསྟུན་ནས།
མཇལ་བའི་དུས་གཅིག་ཤར་ཡོང་།།

21. ཁྱོ།། བྲག་དེ་རྡོ་རྗེ་བྲག་ལ།
རྒོད་པོའི་རྒོད་ཚང་བསགས་ཡོད།
རྒོད་པོ་སྐུ་ཚོ་རིང་ཤོག།
རྒོད་ཕྲུག་གནས་སོས་བདེ་བས།།

22. སྐྱེས།། བྲག་ལ་འཛོགས་རྒྱུ་ཡིན་ནོ།
བྲག་སྟོད་གཡར་རོགས་གནང་དང་།
བློ་ལྟས་འཆོལ་རྒྱུ་ཡིན་ནོ།
བྱམས་སྐྱོང་གནང་རོགས་གནང་དང་།།

23. ཁྱོ།། རྒྱ་གར་ཤར་ནས་ཕེབས་པའི།
ཆུང་འདྲིས་སྲན་མའི་མེ་ཏོག།
ཁྱེད་རང་ཕེབས་པ་ལེགས་སོ།
ཐུགས་སེམས་ལྷོད་པ་གནང་ཞུ།།

TRANSLATION.

(HERE) SOME REPARTEE-SONGS HAVE BEEN WRITTEN, DICTATED BY MRS. LUCK-ABUNDANCE FROM GHOOMPAHAR: HAIL.

First Part.

B = Boy ; *G* = Girl.

1. *B.* That the boot and the boot-leg have separated, how long ago has it happened ?

The boot-leg was not satisfied, but wound itself round the muscle of the calf of the leg.

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2. *G.* You empty beauty from the upper valley, I have the honour to wish you farewell.
In the lower valley I have found (another) snotty.

NOTE 1.—"Snotty." This inelegant word cannot be translated differently. D. "snotneus."

3. *B.* O little bird on the willow tree, don't twitter so much.
If you have anything to say, come out (from your hiding place and come) here near me.

4. *G.* That the willow shakes is by virtue of the nature of the air-element.
Little bird, don't feel anxiety, the roots have (firmly) grasped the ground.

5. *B.* What is in your mind? Speak frankly to me.
I cannot speak in words of prophecy with the occult knowledge of a Padma.

NOTE 2.—The occult knowledge of Padmasambhava.

6. *G.* True, I have found a turquoise, but whether it was a good or a bad one I had no chance to find out.
O all-pervading Master God, may it prove to be a flawless turquoise.

NOTE 3.—Le bon Dieu, der liebe Herrgott, God spoken of in a confidential, familiar manner.

7. *B.* Please, you, who are a Chinese turquoise, don't block the Tibetan turquoise's way.
Please, you all-men's slut, don't stand in the way of those who are properly married.

8. *G.* You old scarecrow, if you have got a cold in the head,
I will give you (some soup) of boiled bone of a dry dog's head.

9. *B.* To the right a walnut tree, to the left an apple-tree. O great chatterbox, I have spent my life in happiness.

10. *G.* There is no question of eating the peaches though the tree is full of fruits.
There is no question of seeking the sweetheart, though gossip is full of rumours.

11. *B.* I set out to stitch a male boot, but it turned out in female shape.
I think there is certainly a karmic tie (between us), don't make yourself too difficult.

NOTE 4.—Tibetan boots are different in shape for men and women.

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12 *G.* From a steep, high cliff, a hare is reading.
I have deeply understood the teaching; I shall not heap up sin.

NOTE 5.—Perhaps the Tibetan hare that reads is like the English little bird that whispers.

13. *B.* O, full moon, if you are to be obscured by a cloud what else will happen to the hare in the moon but to come to an (untimely) end.

14. *G.* Whilst I have not given my heart to another, O, how great is the greed of the other's love.
Whilst the bodies have not been one, O, how great is the greed of the life-mate.

15. *B.* There is a world-forsaking, reality-knowing self-saver (living) between sky and clouds.
Please, good white cloud, make way for me to meet reality (also).

NOTE 6.—"Between sky and clouds" is as much as heavenly, celestial, in this case simply adorable. "you angel," as applied to the girl.
"World-forsaking, reality-knowing self-saver," simply saint. The boy says "you are a saintly angel."

16. *G.* A good horse with wings like the wind, a good man, beautiful like the figure in a picture. When I have seen the wind-like wings, I have remembered the figure in the picture.

NOTE 7.—"Beautiful like the figure in a picture", like the English idiom "she looked a picture," simply very beautiful, applied to men. A horse with wings like the wind, simply "a swift horse."

17. *B.* In a snow-white cup lion's milk has been poured.
O good Master God who art everywhere, let no drop of ink be put in it.

NOTE 8.—'Snow-white cup' is an idiom for a perfect person without fault our blemish.

NOTE 9.—Master God, as above in No. 6.

18. *G.* On the thin perch (sits) that bird steady-like Turquoise-dragon.
That the karmic link between us is finished, O, how can it be true.

NOTE 10.—The name of the bird means only poetic praise, not any mythical bird.

Second Part.

B = Man or Boy; *G* = Woman or Girl.

1. *Woman, Girl.* I have not asked the beloved: be a permanent life-mate.
Remembering my parents for some time, I asked: be my consoler.

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2. *Man, Boy.* Bring some red fire, I will smoke some sweet tobacco.
Bring a small square cushion, I will reflect deeply.

3. *G.* O you pretender of a pipe! The stalk is broken in the middle.
Have you perhaps become certain of a South-Valley bamboo?

NOTE 11.—The whole of No. 3 means only: have you found another sweet-heart whom you prefer?

4. *B.* For a single pipeful of tobacco, good sweetheart, do not scold me.
During my wandering in the wilderness it was even better than the good sweetheart.

5. *G.* O primeval snow-mountains of the Upper-Valley, immutable Great-place-good-snow.
The river flows uninterruptedly, the Nyangtö of the long golden basin.

NOTE 12.—This mountain is said to be on the road to Lhasa a day and a half beyond Gyangtse. Nyangtö, or Ngang-tö, said to be either a village on the eastern bank of the River Nyangchu, near Dongtse, between Gyangtse and Shigatse, situated in a valley which looks, at the time of the ripening crops, like a golden basin, or the river itself at the base of the mountain.

6. *B.* Please sing a song in a sungla tune (such as) of one with a melodious voice,
More melodious than the reading sing-song over there of the man reading Padma's revelation.

NOTE 13.—Sungla, one of the fixed tunes in which poems can be recited.

7. *G.* If for the benefit of my throat I get some pure water from the pure pass,
There is nothing I cannot sing in the way of songs of my own invention.

8. *B.* That the finger-ring is a mixture of iron and copper is truly the kindness of the beloved.
Yet, though I am inclined to slip it on, there is one reason preventing me to speak the final word.

9. *G.* If the turquoise is to be set in the ring, it is now the time to set it.
If not, that small turquoise of flawless quality will not remain long.

10. *B.* I have made over there at the upper part of the lake a dam as strong as a rock.
In the lower part of the lake a golden-eyed fish was left, shedding tears.

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11. *G.* That the dam at the upper part of the lake had been shifted, was unknown to the fish at the lower part of the lake.

That the trunk of the tree was rotten inside, was unknown to Miss Hawk.

12. *B.* Having gone to the shore of the ocean, I have found a string of pearls.

But as there was no golden end-bead, what is the use of the string of pearls ?

13. *G.* O Tibetan child of fate under the small multi-coloured apron,

Don't move your four limbs, I have to seek a father for you.

14. *B.* Whenever I see the willow-grove myself, I have no appetite.

Whenever the thought of the little bird arises within me, my night's slumber is broken.

15. *G.* The good horse is clever at ambling, the good man has disappeared behind the pass.

The man with the beautiful eyelashes, at this moment, where is he ?

16. *G.* If the rain must come down, may it not come down on the dabchi drilling ground.

For Mr. Sergeant Bondieu's hat will lose its colour.

NOTE 14.—The dabchi drilling ground is a military drilling ground about a mile north of Lhasa.

NOTE 15.—In Tibetan a man may have the name "God," but with a familiar connotation like D. Lieve Heer. In G. a Herr Liebsgott or in Fr. a M. Bondieu might be imagined. After all the name is not much stranger than, for instance, that of "Christie." Amongst the Tibetans, as amongst the Catholics, there is a certain amount of familiarity with heaven.

NOTE 16.—The sergeant's hat is part of his costume or a sign of his rank, his badge as it were.

17. *G.* The beloved one is on the other side of the pass. I am on this side of the pass.

If there is (still) any Karma (between us) may we meet at the top of the pass.

18. *G.* O, bird flying in the heavens, O, leaf-lover, you spotted, little magpie, carry (this) news to the girl's drilling ground.

19. *G.* Please tell that in the heart there is heart's sorrow.

Please tell that there is no sickness and no cold in the body.

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Third Part.

W = Woman ; *M* = Man.

1. *W.* The meadows of the mountain called Fish Hill seem very comfortable. Brother little son is like a meadow-ornament flower. O meadow-ornament flower sit on the meadow. I unfortunate girl must go to my own country.

2. *W.* I have slept one night in the bedroom with the window. I have slept two nights, because I could not give up the little boy. O horse-boy, lend me the key of the stable. O horse-boy, I must take out that red-coloured perfect thought (i.e. the horse, the object of the thought).

3. *W.* For that horse I have paid fifty ngulsang. I will put a bell-belt on it for which I have paid three sang. To the far ocean-place the road is rough. O horse-boy, please shoe the horse.

4. *W.* I have asked: remain in peace. He answered: go in peace. And the tail of these farewells has been left behind. And the right-turning tears have fallen.

5. *M.* Streamlet, flow on, flow on. Yes, flow on day and night. I, fish, will put my trust in the Vajra-rock.

6. *W.* If, without reaching, you lift up your heel (stand on tiptoe), the seam of the boot will burst. If you look at a distance without seeing, the nerve of your eye will burst.

7. *M.* The inside of Madam Ashal has been filled up by Mr. Doshel. The inside of the best little turquoise has been filled up with no silken thread.

8. *W.* The cup is as if reddish white. Such are, I tell you, in the Lhasa bazar. Kindness as if of father and mother, they are not in the Lhasa bazar.

9. M. If you listen to the talk of the people then the earth will tremble. I myself, on Padma's cushion, remain without change.

10. *W.* Having enjoyed pleasure as small as a louse, the people's gossip has grown as big as a yak. Having mixed the soft bodies of flesh, what are you going to do?

11. *M.* O king of the black scorpions in the midst of the white sand, having put on a little iron boot, come on to have a fight!

12. *W.* As to the rain falling down from the heavens, I cannot ask it not to fall down. As to the drops under the gutter, surely, I will not hold up (a pot to catch it).

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13. *M.* In the stony jungle amongst the animals, woman is like the hare. The necessary tail is not there, but the unnecessary ears are long.

14. *W.* On the top of the tiger hill pass I have sung a few sweet words. Though the mountain is made of earth and stones, still its head has nodded (for pleasure).

15. *M.* You male horse are not a "siling" horse, and the "siling" horse is not an ambler. You yourself do not feel shy; there is no-one to put on the head-stall.

16. *W.* The tiger pass is not my father's estate, the building is not for always. Having made the square temple I will return to my own country.

17. *M.* Formerly, on the tiger pass, I did not know there was any temple. Now on the tiger pass a magic temple has been built.

18. *W.* O you workmen (masons) dwelling on the tiger pass, do not look at the girl's face. Please look at the corner of the wall.

NOTE 17.—Workmen in the sense of the Indian mistry as against the coolies.

19. *M.* I am very sorry. I am now more sorry than ever before. Not only am I very sorry but even the birds of the heavens are sad.

20. *W.* Don't be much grieved in your mind, O son of the good mountain cloud. After the cloud has passed a time for meeting will come.

21. *M.* On that Vajra-rock there are many vultures' nests. May the vulture's life be long, then the vulture's young ones will be happy.

22. *W.* I will climb the rock. I beg you to lend me the pick-axe. I will put my confidence in you. Do please love me.

23. *M.* O you beloved sweetheart pea-blossom, who have come from Eastern India, you are welcome; please let your mind be completely at ease.

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सन्दर्भ ग्रन्थ
REFRENCE BOOK

The Oldest Christian Tomb in Northern India and the United Provinces.

By Mesrovb J. Seth, M.R.A.S.

It is not known perhaps that Agra which possesses the most magnificent Mausoleum the world has ever seen, contains at the same time the oldest Christian grave in Northern India, a grave much older than the one enshrined in the world-famed Taj.

But where is this most interesting grave to be seen? There stands in the beautiful old Armenian Cemetery at Agra (now called the R.C. Cemetery) an octagonal, though quite unpretentious Mausoleum as compared with those erected afterwards in the same cemetery to the memory of Hessing, the notorious Sumru and other military adventurers. And in that edifice, which is the *oldest Christian* structure at Agra, and is known as the "Martyr's Chapel," is to be found the grave of a rich and very pious Armenian merchant called "Martyrose" who died at Agra in the year 1611 A.D.

But before proceeding with the description of the tomb and the bi-lingual inscriptions on the same it must be pointed out that the Armenian name "Martyrose" Մարտիրոս means literally a "Martyr," hence the present nomenclature of the Mortuary Chapel, although some over-zealous Catholic writers and antiquarians have tried to connect it with the martyrdom of the two Jesuit Fathers who died in prison during the reign of Shah Jahan and whose remains were brought and buried in "Martyrose's" chapel, there being no other consecrated ground at Agra at that time.

As you enter the Mortuary Chapel referred to above you will find on the right hand niche two mural tablets of sandstone, one with an Armenian inscription at the head, and the other with a Persian inscription at the foot of the grave. I regret however to observe that the ruthless hands of the vandal have not spared those tablets as there are distinct traces of cement plaster on them which clearly shows that they must have been plastered over and whitewashed at one time and later on, when in the interests of Archaeology, the plaster was removed by some unskilled workmen with the help of a pickaxe evidently several of the letters on the tablet became badly chipped, and it was with considerable difficulty that I succeeded in deciphering the inscription, and that with the help of a powerful magnifying glass.

After what had befallen the said two mural tablets, I

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suspected at the time that other tablets on the walls of the Chapel might have been similarly summarily dealt with by vandal hands and I have since found that my grave suspicions and misgivings were not at all unfounded, for to my horror I find in Blunt's "Christian Tombs and Monuments in the United Provinces" the following ominous lines at page 38:—

> "All the Armenian inscriptions (save that of Khwaja Mortenepas) were on the walls and are now hidden behind a veil of whitewash from which I hope that some day they will be rescued."

I have since this terrible disclosure requested the Archæological Department at Agra to remove the plaster on the walls of the Mortuary Chapel, and expose to the light of day the valuable treasures that may be hidden there, and I venture to hope that the worthy custodians of "Ancient Tombs and Monuments" will comply with my humble request and thereby save from oblivion the valuable landmarks of my countryman in the once glorious capital of the mighty Moguls. Now to the bi-lingual inscriptions of which correct copies are given below.

ARMENIAN.

ՀԱՆԴԱՒ Ի ԱՅՍ ՏԱՊԱՆՍ ՓԻՐՔԱ
ՀԻՆ ՈՐԴԻՆ ՄԼՏԵՍԻ ՄԱՐՏԻՐՈՍ ՔՈՒ
ՂԱՅԻ ՎԱՂՃԱՆԵՑԱՒ Ի ԱԿՈՒԱՅ
ՓԱՂԱՓԻ ԵՒ ԱՊՐԱՆՔՆ ԵՏ ԱՅ ՎՈ ԻՒՐ
ՀՈԳՈՆ. ԹԻՎ ՀԱՅՈՑ ՌԿ:

PERSIAN.

اینجا مدفونست خواجه مرتینس ارمنی مقدسي
که خود را غلام کریستس می گفت و چون
صاحب خیر بود هرچه با خود داشت بنذر
انحضرت بفقرا ایثار کرد
یک هزار و ششصد و یازده از تولد حضرت عیسی

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There have been several translations of the Persian inscription since 1876, but none of them has given a correct rendering of the original into English as will be seen presently. The Armenian inscription is being translated here for the *first* time and is as follows :—

> "In this tomb rested the pilgrim Martyrose son of PHEERBASHI of Julfa. Died at the city of Agra and gave his goods to God for his soul. 1060 of the Armenian era."

There could not have been any slab over the grave of the Armenian Martyrose as the Archæological Department have recently placed a white marble slab on the grave with the following inscription which is likewise a translation though not a correct one, of the Persian inscription at the foot of the grave ; it runs thus :—

> "Here lies holy Khwaja Mortenepus Armenian who was a professed disciple of Christus and who was a righteous man whatever he had he gave in charity to the poor in token of fidelity to his adored master. In the year One Thousand, Six Hundred and Eleven from the birth of Christ."

First and foremost the name of the deceased which is the most essential part of the epitaph has been wrongly translated, for instead of the Persian "Martinus," the Latin for Martin or Martyrose, the erudite translators have got—I cannot understand how or from where—the jaw-breaking name "Mortenepus" which is certainly not an Armenian name. Then again, the word "Moqdesi" مقدسی which in Armenian means a pilgrim (one who has visited the Holy Sepulchre at Jerusalem) has been wrongly translated as "Moqaddasi" meaning a "holy man," and in the same arbitrary way the Persian Word "Gholam" غلام (a slave) has been wrongly translated as a "disciple." What a faithful translation ! As there are several glaring inaccuracies in thes aid translation, I shall therefore give a correct rendering of the original Persian inscription :—

> "Here lies interred the Armenian Khwaja Martinus the pilgrim, who called himself the slave of Christus, and as he was of a charitable disposition whatever he possessed he gave in charity to the poor as a gift to that Master. One Thousand Six Hundred and Eleven from the birth Jesus."

Now a person who humbly called himself the "slave of Christus" (Քրիստոս) the Armenian for Christ, would turn in his grave if he were called a "holy man," so that the worthy translators have done a great injustice to his memory by calling him "holy." I would in this connection humbly suggest to

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the Agra Archæological Department to remove the misleading inscription on the present marble slab replacing it by another with the correct translation of both the Armenian and Persian inscriptions as given above by me.

Now let us see who this pious and charitable Armenian merchant was and where he came from My good and learned friend Father H Hosten, S.J., of St. Joseph's College, Darjiling, has published in his interesting account of Mirza Zul-Qurnain (an Armenian Grandee at the court of Akbar, Jahangir and Shah Jahan) the following letter written from Agra in 1612 which throws a flood of light on the subject of this article. Father Joao de Velasco, S.J., writing his "Annual Letter" from Agra on the 25th day of December, 1612, says :—

> "The King granted us for burying the Christians a convenient and ample ground, whither the remains of the Christians were transported amid solemn prayer on the 2nd of November (All Souls' Day); the presents offered by the Christians for the dead were distributed among the poor, whether of the faithful or of the Pagans; whatever remained was carried to the Jail to comfort the prisoners which act of charity astonished and edified the Moors not a little. Lately this place was adorned with a chapel (templum) erected with the alms of a pious Armenian, who free from the bonds of wedlock after the death of his wife, went to Rome and Jerusalem on a pilgrimage to the holy places of our Redemption. From there he went back to his country (*patria*) and bestowed on the two sons left him after his wife's death whatever they had a right to, after which he devoted himself so wholly to God that he called himself the Lord Jesus' Slave (*mancipiolum*) and did not allow others to call him by any other name. However, he travelled divers countries as a merchant buying and selling goods and making profits amounting to many thousands of gold pieces (*aurei*—Gold Mohurs). But all his gains he gave away to the poor or spent in other works of piety and charity and that so faithfully that he was loth to subtract anything for his own sustenance, for he would say repeatedly that these goods were no longer his but the Lord Jesus' to whom he had consecrated himself. Once after a very long time, five thousand gold pieces were adjudged him at last in a law suit, when, to the judges wonder, he presently distributed among the needy the money he had received; he ransomed very many captives from his own purse, relieved many in their wants, gave dowries to poor women of good character and thus like the Lord Jesus' very faithful servant, he spent his goods and his life. Doubtless, he deserved to enter into the joy of his Lord. He was buried in the Chapel (*in temple*) he had built and he asked Father Xavier to write over his tomb: Here

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lies Martin (Martinus) the slave of the Lord Jesus.' This was done and after his death all that remained of his goods was partly spent in building and adorning the Chapel, as he had ordered, partly given to the poor whom he had appointed heirs to his property."

The above testimony from the pen of a good Jesuit Father, who evidently knew the pious Armenian personally, is eloquent proof of the goodness of my noble countryman.

My good Jesuit friend, Father Hosten, who brought to light the above highly interesting letter and to whom I personally am very grateful for the valuable discovery, comments on it as follows :—

"Is it not pathetic that the inscription on that good man's grave should have been so long a puzzle to antiquarians or that his good deeds should be made public again after an oblivion of three centuries? The inscriptions on his tomb, both in Armenian and Persian, are near the right hand recess of the octagonal Chapel as one enters. These lines, the *oldest* in the cemetery, will have been read at times with incredulity, as a piece of vain boasting. How modest an expression they are of great realities and of the gratitude of the poor."

The History of this old Armenian Cemetery at Agra has yet to be written as there are in the present day, despite the ravages of time and the elements, about 120 graves with Armenian inscriptions still to be seen in that cemetery, many of them of historical value, dating back from the early part of the 17th century down to the middle of the last century. Armenians from all parts of the East, with several priests lie buried there. There are amongst them eminent merchants, skilled artisans, brave soldiers and military officers, all with a history, and it clearly shows that the Armenian colony at Agra must have been a prosperous one in the palmy days of the Mogul Empire. For a fuller account of the early Armenian settlers in this country, see the "History of the Armenians in India" by the writer of these lines.

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17. The Rig Veda—A Note on the Arrangement of the Books.

By G. R. Kaye.

It has long been recognised that the arrangement of the books of the Rig Veda is based upon some arithmetical principle, which, however, has not yet been formulated.

The Rig Veda consists of ten *mandalas* (cycles), or 'books' as they are generally called. Books ii to vii are, more or less, homogeneous in character while books i, viii, ix and x differ considerably from the others in arrangement. In books ii to vii the order is that of the deities, and the hymns for each deity are arranged according to their length. According to tradition each of these books was the work of a particular family of Rishis and hence they are termed the 'family books.' Book viii is also a 'family book' but differs from the others in not being arranged in the orders of the deities. Books i, ix and x are not completely arranged on any of these bases, while book ix is differentiated from all the others by having all its hymns addressed to one deity, Soma.

The ten books contain 1,017 hymns distributed as follows:—

i	ii	iii	iv	v	vi	vii	viii	ix	x
191	43	62	58	87	75	104	92	114	191

The fact that the numbers of hymns in the first and last books are the same has, of course, been noticed, but it should also be noted that the sum of the hymns in books v and vii (87 + 104) is also 191, and further that the other books arrange themselves into two distinct groups. There are thus three distinct groups which are exhibited in the following table:—

	i	ii	iii	iv	v	vi	vii	viii	ix	x	Totals.
A		43	..	58	..	75	..	92	..	..	268
B		..	62	..	87	..	104	..	114	..	367
C	191	..	..	..	..	..	..	..	..	191	382
											1,017

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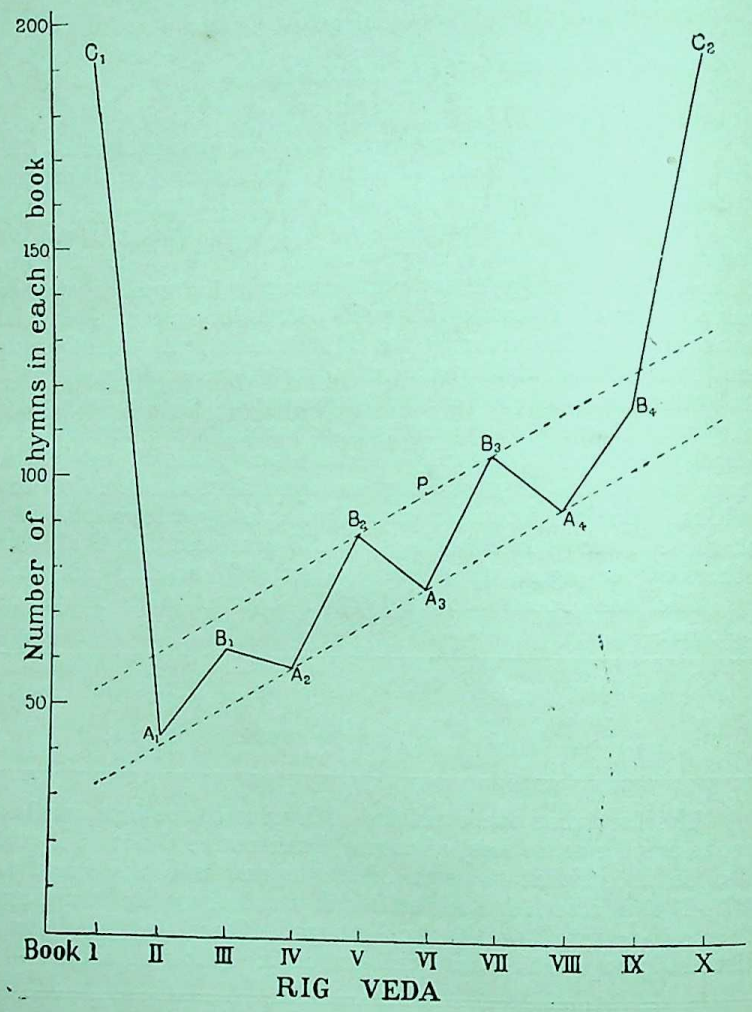
The diagram below perhaps exhibits the grouping more distinctly. It is, at any rate, interesting and suggestive.



The parallelism between the lines B_2, B_3 and A_2, A_3, A_4 cannot be accidental. Neither can the facts that P (the mean between B_2 and B_3) has exactly half the value C_1 or C_2, and that A_3 is the exact mean of A_2 and A_4 be accidental. The positions of B_2 and B_4 should also be noted.

Of the individual books we note the following peculiarities: Each of the 'family books' is divided into two or more main groups and finishes up with what may be termed a tail-end

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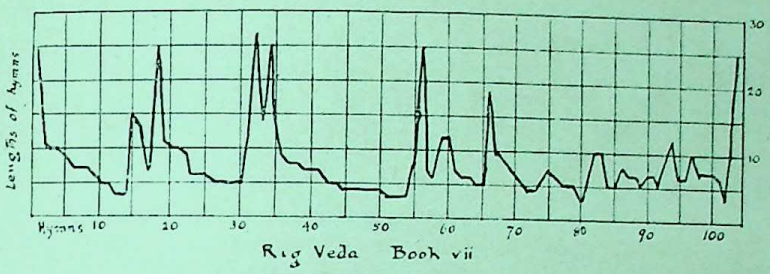
group.[1] The main groups are in descending order of the lengths of the hymns but generally the tail-end of each group is on the rising gradient, and also in all cases but one the last hymn of a book is longer than the penultimate hymn. (See the sample diagram of book vii below.) In the main groups



Rig Veda Book vii

there are exceptions to the tail-end rule, but for the ends of the books themselves the only exception is book ii, and the last two hymns of this are well known to be peculiarly placed.

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[1] The last group of book iii consists of five hymns only and seems to have been curtailed for some reason or other.

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PROCEEDINGS OF THE EIGHTH INDIAN SCIENCE CONGRESS.

The Eighth Annual Meeting of the Indian Science Congress was held in Calcutta from January 31st till February 5th, 1921. After the Patron, His Excellency the Rt. Honourable the Earl of Ronaldshay, G.C.I.E., Governor of Bengal, had opened the proceedings in a short speech, the President, Sir Rajendra Nath Mukerjee, Kt., C.I.E., delivered his address.

Presidential Address.

My first duty is to express my gratification at the honour you have done me in electing me your President for this session of the Congress. The mere fact of your electing me, a non-scientific man, to preside is a sufficient indication that you do not expect me to deal with purely scientific subjects or to express myself in the language of the scientist. It is nevertheless with some diffidence that I address this assembly of scientific men to-day. Science has been described as organised knowledge. The classification of facts, the recognition of their sequence and relative significance is the function of science. But science has to do with everything to which its method can be applied and I shall content myself by saying only a few words from the standpoint of a spectator, who watches the result of the work of this Congress and its application for the benefit of mankind. The progressive economic development of civilised nations is attributable to the perpetual and ever-increasing growth of man's power over nature, by the help of scientific investigation. The numerous discoveries that are being made daily have only been sufficient to reveal that our knowledge of the properties and laws of physical science is still in its infancy. But it is advancing more rapidly and in a greater number of directions than in any previous generation, and the knowledge derived therefrom is being rapidly converted by practical ingenuity into physical energy. It is evident therefore that the industrial progress of the world is dependent upon the union of science and industry and upon the co-operation of the different branches of science with each other. The present generation is being compelled to recognise the urgent demand of the working classes for greater leisure and for a higher standard of living, a demand which can only be met by an increased command over the powers of nature; and this can only be obtained through increased knowledge. Being myself a mere industrialist, I must naturally allude to your close relations with us and gratefully acknowledge the benefits which

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we derive from such a body of scientific men as that of this Congress, for the development of industries.

This Congress, during its short life of seven years, has already firmly established itself in the confidence of scientists and the general public and has undoubtedly given a great impetus to the promotion of scientific discoveries and their application for the development of industry.

In the past, business men were inclined to disregard the usefulness of science as applied to industry or accepted its benefits without being conscious of their source; but they are now firmly convinced that science is an invaluable aid to the development and advancement of industry, and that the dissemination of scientific knowlege with its experiments and discoveries is an essential condition of industrial progress. They are, moreover, fully alive to the fact that applied science is nothing but application of pure science to a particular problem, the solution of which some manufacturer has found necessary in order to improve, if not indeed in some cases to save his business. The improvement in manufacturing processes can only be achieved by the application of science and the prosperity of any industry is based on this fundamental truth. It has been truly said that the foundation of industrial advance was laid by workers in pure science for the most part ignorant of its utility and caring little about it.

It has now been generally recognised by every business man that scientific research is an absolutely necessary condition of industrial advancement. The progress of Indian industry in particular, owing to our lack of scientific knowledge of its raw materials and special problems is inseparably bound up with the progress of science, research and discovery. We must recognise that science is our best friend, a working partner always willing to work for a bare subsistence to increase our profit. Scientists are sometimes looked on by business men as rather impracticable individuals; but it seems to me that the latter do not make sufficient allowance for the ideals and methods of scientists. Scientists and poets alike are inspired by their need for self-expression rather than the hope of making money. Neither of them can hope to succeed without originality and inspiration, and both have, each in their separate ways, laid the human race under a deep obligation. I would ask my fellow-workers in the field of industry to recognise the value of scientific workers, both by liberality towards the individual, and towards the cause of science.

If India is to advance commercially and also economically, she must spend money on scientific investigation. After the lesson the Government of India has had during the war, there is no doubt that more attention will be paid to and more money spent on the encouragement of scientific methods in our industries. The scientific investigator should be provided with

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means and facilities necessary for the proper pursuit of his work. If scientific research is to yield the maximum benefit to industry, research students must live in close touch with industrial conditions. The gap between the laboratory and the shop must be bridged.

Apart from the practical help and encouragement given by Government I think it is part of the duty of all commercial and industrial concerns which benefit, directly or indirectly, from scientific research, to set aside a portion of their enhanced profits for the purpose of contributing to scientific associations like this to enable its members to extend their work and devote more time to further discoveries.

This Congress has charged itself with the function of bringing together from year to year in a convenient form the results of the researches and discoveries of those who are engaged in the different branches of science. These have been collected and reproduced in the annual proceedings of the Congress. It is not only most important but essential for the benefit of the whole of India that these discoveries, made by different scientists in different fields of work, should be brought to the notice of every one likely to be interested. Sufficient funds should, therefore, be in the hands of your Committee to enable it to make its work known to the public, so that any one who takes an interest in a particular subject may readily obtain information. The objects of the Congress should be the advertisement of its activities to the non-scientist; the exchange of information between scientists, and the encouragement of them in their several activities. Make clear to the industrialist and to Government the practical benefit you are conferring on them and on the country generally, and they will give you their money and their support. Show the intelligent public that practical work is going on, in which their interest, though often indirect, is always considerable; make them realise what the spirit of science means, and familiarise them with scientific methods; it will be good for their minds, and will educate public opinion in a direction helpful to the cause you all have at heart.

It has been aptly said that science has its hand on the lever controlling the major physical facts of our existence. The war has shown us the way, and we now see before us a new prospect of unlimited possibilities of developments. The importance of the skilled chemist has been abundantly shown by the war which has proved beyond doubt that the best assets of a country are its scientific investigators and inventors, and that wars are won not only by the strength and number of the armies engaged but in the laboratory and the factory.

We owe to the achievements of science all the benefits and most of the comforts of modern civilisation, but it is a strange fact that great honour or profit are seldom the rewards of a

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life devoted to science. Generally speaking our best scientific men work on a mere pittance, for the love of their work, but however beneficial their results may be, they usually die poor and unrecognised by Government and the general public. Caring little for fame and less for wealth, they work for the achievement of results which when accomplished seem to be the only reward they care or hope for and they covet nothing else. Scientific enquiry is noble in itself and is its own reward. Nevertheless if science is to be of practical use to the world, scientific investigators should be duly encouraged and honoured and not left to starve. The prospects of India are unlimited if its unfathomable resources be developed by discoveries made by scientific research.

There are signs that the application of science to productive industry is daily increasing in India, but we require more scientific men and industrial chemists, and this Congress can at this opportune moment give an impetus to the policy by which this want can be met.

We are grateful to Lord Chelmsford's Government for the active interest it has taken in establishing research institutes, both Imperial and Provincial, the investigations and results of which will be available to the industries concerned. Of course, these institutes do not imply any disregard of the interests of pure science which will always attract independent workers. Until a sufficient foundation of pure science has been successfully laid, there can be no applied science. Real progress comes from the pursuit of knowledge for its own sake. Not infrequently a research which has been undertaken in the interest of pure science has proved to be of the greatest value to industry and the difference between pure and an applied science is stated as merely one of intention.

Apart from the vast mineral resources of the country lying undeveloped, the agricultural possibilities in the country are capable of vast development; but the people have not yet been educated up to taking full advantage of scientific methods of cultivation. The world is in need of more food and more raw materials for industries. The prospects of increased agricultural production are almost unlimited. The possibilities of improvement by scientific cross-breeding on Mendelian lines have been fully shown, but little has yet been done, I believe, to study the way in which, and the reasons for which, plants produce the valuable products for which we cultivate them, though much has been done to facilitate the study of the growth of plants by the researches of my distinguished friend, Sir J. C. Bose, F.R.S. The work along a combination of such lines as these, though it may take a long time, offers almost unlimited possibilities. The publication and distribution of the papers read in this Congress on this subject should be undertaken free of all cost. This Science Congress is a co-operative organisa-

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tion—a process of cumulative effort in scientific advance, and I may be permitted to repeat that it should be the distinct function of this Congress to disseminate at a nominal price the useful and valuable informative papers which are read and discussed by the members relating to scientific research and discoveries, and I am confident that if this Congress takes such a step, funds will be forthcoming both from Imperial and Provincial Governments and from commercial concerns as well.

The metallurgical industries, the making of machinery of every kind, the engineering, the electrical and the chemical industries, the making of high class textiles, glass, porcelain, optical and surgical instruments and scientific agriculture are activities which cannot be carried on without the highest scientific and technical skill, and the members of this Congress are deserving of the gratitude of the commercial community for their work. Nor is the health of the workers the least important factor in the industrial success of a country. The commercial and industrial people of Bengal are thankful to H.E. Lord Ronaldshay for the keen interest taken by him in the improvement of the health of the working classes. I venture to suggest that the Congress should direct its attention to the application of the sciences of physiology and psychology for the study of the individual worker in all his relations to industry—mental, moral and physical—for the benefit of Indian industries.

Gentlemen, in closing, let me refer once more to the compliment you have paid me as an industrialist in inviting me to preside over this session of the Congress; but I see in your action much more than a mere compliment to industry. I regard it as a recognition on the part of men of science of the indissoluble bond which must exist between industry and science. Science is stretching out a hand to industry, and it is for industry to appreciate the common need and to respond to the advances of science without stint or question. This alliance of the ideal and abstract, with the practical and material activities of the human mind, is not only a necessary condition of progress, but improves the mental outlook of every person who is affected by such a movement. Let us look forward, therefore, to a future in which the scientist, the industrialist and the administrator with a just appreciation, each of his own responsibilities and of the great possibilities which lie in the work of the other, will move towards a common goal, the utmost possible command of mankind over the forces of nature, to be used for the general betterment and greater happiness of mankind.

Gentlemen, I will not take up more of your time. But allow me to thank you once more for electing me your President and for your indulgent and patient hearing of my address.

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Section of Agriculture.

President :—S. Milligan, Esq., M.A., B.Sc.

Presidential Address.

A review of the world's progress in agriculture during the last forty years reveals an immense and ever-increasing amount of scientific work on matters concerning that industry. During that period great strides have been made in soil chemistry and biology. Much light has been thrown on plant physiology and on the functions of that group of substances usually termed plant food. Modern plant breeding has developed, animal nutrition has been the subject of numerous exhaustive investigations and great progress has been made in the study of milk products. From the point of view of practical farming, we find that most improvement has been effected during the period in the breeding, feeding and treatment of stock, in dairying and in plant breeding and in the treatment of pastures, and there is no doubt that along these lines (with the exception of the breeding of live stock) improvement has been the direct outcome of scientific work. The study of soils and plant physiology has, on the other hand, led to little change in actual cultivation practice. In the West tillage remains much where it stood. Before our day crops were grown in rows and intercultivated, ploughs and cultivators were much the same as they are now, and the value of manuring was thoroughly recognized. Stagnation probably arose from the fact that science had little of value to suggest along the lines imposed by existing conditions. Pending some marked improvement in power or implements, sufficient to permit of considerable variations in practice, these restrictions appeared likely to remain. Europe is, however, now on the threshold of very great possibilities through the development of the agricultural motor tractor through which it will now be possible to plough the subsoil to a greater depth, and to cultivate and sow under conditions more nearly approaching the optimum (hitherto impossible in unfavourable seasons) and to time operations so as to ensure the minimum loss of soluble plant food. It may even be possible to vary considerably the cultivation of the lea break, a matter which up till now has presented almost insuperable obstacles. Any one who has experience of agriculture in Europe can thus see immense possibilities owing to this sudden access of power by which a man is able to control three or four times the amount hitherto possible. Whether science will be able to assist materially the Western farmer in making the most of the new conditions remains to be seen, but it requires little imagination to see a useful field for properly organised investigation.

To those who have followed developments in India, it would seem that the introduction of new implements should

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similarly improve the prospects of a change in agricultural practice. When it is considered that, until a few years ago, practically the only implements to be found on the alluvial tract of Northern India were the plough and the levelling beam, while to-day the more important of Western implements, made lighter and most suitable for draught by Indian cattle, have been introduced with growing success into many parts of the country, it would be a strange thing if all this did not signify, in some way or other, a possibility of greater variation in tillage operations. Although the undoubted success hitherto met with in improving crop production in the country by improved tillage may be said to be due more to a greater efficiency of the existing methods of cultivation than to a change in the methods themselves, still there is no doubt whatever that through improving farm implements a greater control over the soil has been attained, and, consequently, a greater possibility of approaching more nearly to optimum conditions for crop growing. For example, the furrow turning plough has given a vastly increased power of turning surface organic matter ino the soil. The possession of field cultivators means the possibility of a more thorough soil preparation. Drill cultivators and harrows, the use of both of which amongst growing crops is increasing and giving good results, permit of a greater control of soil moisture and of the concentration of the soluble plant food, particularly nitrates, at depths more suitable to the plant. By the use of rollers and soil compressers a more rapid rise, and concentration of soluble plant food at higher levels is made possible. Finally the advent of the ridging plough means, amongst other things, the possibility of applying smaller quantities of irrigation water per acre and of improving its distribution.

Thus a combination of implements, likely to give us a much greater control over tillage and irrigation, has been introduced into the country and opens a new field of usefulness for agricultural investigation, new in the sense that there is now a possibility of *applying* some of the more recent work done with regard to soil chemistry and physics, soil bacteriology and plant physiology to practical agriculture. For example, it is obvious that, in order to reap the advantages gained by the introduction of new implements, we should be put in possession of a better knowledge of optimum soil conditions for crops both before planting and during their growth and should have more information about the movement of soil moisture in various classes of soil under varying conditions. Closely connected with this subject is the question of manures and their application. At present we are hopelessly in the dark with regard to the quantitative side of manuring and to some extent as to the best times of application although it is certain that manures are used in a most uneconomical way. It is probably largely because of this that the value of soluble artificial manures has

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not been more generally recognised and it is significant that the best results have been obtained by the use of comparatively slow acting manures such as bonemeal and oil cakes which are applied in greater quantities than the more expensive soluble fertilizers. Is this not largely due to the present ignorance regarding time, quantity and location, coupled, possibly, with the difficulties hitherto met with in administering the dose at the proper moment and in the correct place? For a man to attempt to control distribution of a soluble manure, armed with nothing else but a plough and a levelling beam, is probably asking too much; but the day for this is over and it is now possible to apply manure and concentrate it at a much greater range of depth than was possible before.

It will readily be admitted that in all investigations affecting new operations a careful check should be kept on the results of these on soil fertility. The worst thing that can be done is to encourage the cultivator to improve his present outturn at the expense of posterity. For example, the question of the maintenance, if possible, of the organic matter in the soil is one of very great importance. Although it is quite possible to imagine that the effect of a more intensive cultivation might lead to a depletion of organic matter, it is equally possible that ways and means will be discovered not only for maintaining it at its present level but also for increasing it in the ordinary course of cultivation.

The view expressed that well directed investigation into optimum conditions for the growth of the various crops coupled with a knowledge of what is actually happening in the soil will lead to great improvement in agricultural practice is not mere optimism but the result of a somewhat extensive acquaintance of agriculture in the East and in the West. I should like to point out a few examples, which come to my mind of work which would be almost certain of a successful issue in India. I have above, for want of a better term, used the expression "optimum conditions" by which I mean those conditions which are most suitable for the growth of plants. As an example of the occurrence of such conditions in nature, we may refer to what are usually called in official statistics "bumper" crops. These crops exceed by large amounts what we call "normal" crops or crops produced under generally favourable but not "optimum" conditions. Their occurrence, of course, is rare but occasionally you get good examples. They had such a crop of wheat in certain parts of the Punjab last year. At the Lyallpur Agricultural Station, for example, a wheat crop was harvested which exceeded a normal or fairly good crop by about 50 per cent. The occurrence of such a crop show, of course, the absence of unfavourable conditions, but, at the same time suggests a combination of favourable circumstances before and during the growth of crops. The conditions whatever they were, must have been

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meteorological, combined with a fortuitously favourable timing of the irrigation. Now if we only know exactly what these favourable conditions were, might we not so control our operations of watering, draining, cultivating and manuring as to make the normal approximate the present bumper? And the same applies to many other crops. Take cotton for example. The advent of the ridging plough tends to a much better control of irrigation water and ought to help us to regulate to some extent at least the position of the soluble plant food in the soil. Further, one of the chief problems with regard to cotton growing is to prevent the plants from shedding their bolls prematurely. Under a properly regulated irrigation system this should be quite possible but a way out has not yet been found, owing probably to the non-utilisation of our present means of control.

With reference to the possibility of the use of manures in directions hitherto unthought of, I should like to point out an instance witnessed by myself near Dacca on the extraordinary effect of a small dose of bonemeal on a paddy crop. It was in the year 1918 in which, as you probably remember, the monsoon ceased early, and a magnificent looking rice crop throughout Bengal turned out about 30 per cent short of normal owing to drought. Just outside Dacca amidst a large stretch of the higher transplanted paddy land, the crop on which was dried up and prematurely ripened, were to be seen a few fields which had been manured with bonemeal, fresh, unwithered, and properly ripened, giving every appearance of having been irrigated, although no irrigation had been applied, nor, indeed, was such possible. There was a genuine result, nothing accidental about it, demonstrating some great principle of immense potential value to the country. The whole thing was very striking and suggestive, and, it is hoped, will yet lead to results apart from the more immediate conclusion that, under certain conditions proper manuring in years of drought may save the crop.

To revert, the improvement in the equipment of the ryot in tillage implements coupled with a knowledge of how to use these to the best advantage, and with a judicious use of manures—probably in small quantities given at the psychological moment—will render it possible to make a considerable advance on present practices and to increase crop outturn appreciably. That the best results, however, will not be obtained empirically will be at once conceded when it is considered that improvement will be mainly in the correct timing of operations. Moreover, investigations carried out in the usual agricultural fashion, i. e. by plot experiment alone, cannot be expected to give the desired results. The more detailed knowledge that we now require regarding soil conditions can only be revealed by work in the laboratory. The agriculturist is hopelessly handicapped in investigations of this nature unless laboratory assistance is at hand. Again, the optimum condi-

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tions for crops will require to be worked out from the botanical standpoint and will also require work of a specialized character. Further, it is necessary that the work should take the form of a more or less concentrated investigation of particular subjects, research work, as a rule, being not immediately applicable to practice. Success is thus most likely to follow joint investigations in particular directions. What these should be depends on circumstances. A form of concentrated investigation which has already produced results of benefit to planters and could, doubtless, be vastly improved may here be mentioned, viz. specialization in crops. Different crops or, at any rate, different groups of crops require different soil conditions, different timings, etc , and a thorough investigation of optimum conditions for each crop or group of crops, combined with a local knowledge of the behaviour of the soil under varying meteorological conditions would enable the agriculturist to work out a rational system of agriculture based on a full knowledge of what his crops require and how far these requirements are being met.

At any rate it must be conceded that in addition to an adequate provision for research, which must be uncontrolled and unfettered, a special organization of investigation is called for in order to make the most of the large amount of work which has already been done in India and elsewhere with regard to soils and crops; to fill up the gaps in our knowledge, and to connect up the whole with practical agriculture ; and further that such investigations should not be in the form of isolated and unconnected pieces of work but should be concentrated, with the object of a more or less immediate application of the results.

The plant Carica Papaya and its enzyme.—*By* P. B. Sanyal.

Introduction :—Systematic cultivation of Papaya plant in India for industrial purpose has not yet received much attention. The proteolytic property of its milky juice has led many to investigate its nature in detail but the literature is rather numerous and sometimes contradictory. The writer is thus prompted to study the cultivation of the plant, the quality of the fruit produced at Pusa and to discuss the commercial prospect of the papain industry in this country. The subject is divided into three parts, viz :—(1) Agricultural, (2) Bio-chemical and (3) Commercial aspects.

Agricultural Aspect.—The history, various uses, details of cultivation, asexual propagation and breeding of the plant are dealt with in the paper. In this connection it may be interesting to mention that the plant has been found to change its sex on many occasions on cutting off its head.

Bio-chemical Aspect.—From the general composition of the fruit and the change on its ripening it seems that it obtains its sugar by translocation from the trunk of the tree. The preparation of the crude papain consists in rapidly drying the milky juice, while for refined product the latter is precipitated with rectified spirit and washed with ether. The products are standardized for valuation. Composition of a sample of

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papain prepared at Pusa, its digestive value and the conditions under which the maximum activity of the enzyme could be obtained are dealt with in three statements.

Commercial Aspect.—From the export figures of Ceylon of 1911-13 and that of Montserrate 1916-17 it appears that there is already a good market for genuine papain and the demand is on the increase. Commercial papain is sold in Ceylon @ Rs. 5 to Rs. 7 per pound and the purified product @ Rs. 9. From the yield of papain per tree, number of trees per acre grown, cultivation charges, etc., the net profit is calculated to be Rs. 1,000 per acre. The activity numbers of papain produced in Ceylon, Mexico, the Philippines, etc., and also of that prepared at Pusa are compared. Some recipes of the commercial preparations, viz. Vinum papayotin, papain tablets, elixir of papain, eczema cure, etc., and also other probable utility of the fruit are stated. Some household recipes for the utilisation of papaya fruit are also mentioned at the end.

A preliminary note on the increase of grape yield.—*By* S. H. Prayag.

In order to increase the yield of grapes, the methods adopted in Ganeshkhind Botanical Garden, Kirkee, from 1913, may be divided under the following heads:—

(i) Training methods. (ii) Study of the pollen. (iii) Influence of stock as affecting the yield. (iv) Manurial treatment.

1. *Training methods.*—Besides the usual method of training the grape, viz. the Single Stake system (in which each grape plant is trained to a single Pangara plant), other methods of training were adopted. These were: (*a*) Umbrella; (*b*) Over-head; (*c*) Kniffin; (*d*) Junnar. The merits or otherwise of the methods can be summarised as follows:—

(i) The Umbrella system has so far been found to give better yield than others. It remains yet to be seen how far this system could be adopted on field scale.

(ii) In the year 1919-20, the Over-head system has given three times as much yield per plant as that on Single stake in the variety Fakadi, the amount of space occupied being the same in each case.

(iii) The Junnar system has given a better yield than the single Stake system, but entails a good deal of manual labour.

2. *Study of the pollen.*—In the Ganeshkhind Botanical Garden, Kirkee, some varieties were found to have clusters with the berries not so closely packed as the Bhokri. Examination of the pollen grains of the flowers of such varieties did not reveal the characteristics noticed in the flowers of sterile varieties of America.

The trials of Ringing the canes before or after the formation of leaves have so far failed to give good results in the case of the variety Pandhari-Sahebi.

3. In the trials at Nasik, Fakadi on Bhokri stock has given 2 lbs. more yield per plant than Fakadi on its own roots.

4. *Manurial treatment.*—Amongst the manures tried, a combination of Fish and Sulphate of Potash has given favourable results.

Relation between the indican content of Java indigo (*indigofera arrecta*) and the kinds of nitrogenous manures.—*By* N. V. Joshi.

Pot culture experiments on manuring of Indigo have been carried out in order to ascertain the effect of the nitrogenous manures and inoculation of different nodule organisms on the indican content of the leaf. For this purpose Indigo has been grown under controlled conditions in

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sterile sand as also in Pusa soil. The conclusions drawn from these experiments may be summarised as follows:—

Addition of nitrates gives the largest increase in the percentage of indican in the indigo leaf.

The increase in indican content is much less in all other treatments, viz. the addition of ammonia, sterile plant extract and the inoculations with different nodule organisms. All these treatments, however, have a tendency to increase the leaf growth, sometimes to such an extent as to compensate for the lower percentage of indican.

Addition of cowdung and cowdung plus straw gives a poor growth of indigo plants as well as low percentage of indican in the leaf in the first cutting, showing that the Nitrogen in these cases is not immediately available for assimilation by the plants.

In the *khunti* crop addition of cowdung plus straw shows remarkable increase in leaf growth accompanied by low percentage of indican which effect is similar to that of the addition of ammonia or inoculation of nodule organisms.

A note on the variation in the composition of milk of individual buffaloes.—*By* D. L. Sahasrabuddhe.

The Colostrum or the first milk is very rich in all the constituents, but it is especially so in albumin which is nearly ten times as much as in normal milk. In all the constituents except albumin the milk becomes normal in four days while the albumin takes about six days to come down to its normal proportion.

During the rest of the lactation period the solids not fat are fairly constant but fat regularly increases up to the end. Total proteids and case in increase slightly with the advance of the lactation period but the albumin, once it becomes normal, remains so to the end.

A note on the changes produced in heated soils.—*By* D. L. Sahasrabuddhe.

The general effect of heating on the physical condition of the soil is to make it less sticky. By heating the soil its inorganic as well as organic substances become more soluble. The catalytic power of the soil decreases by heating. The rate of oxygen absorption in the soil is increased by heating. If any protozoa are present in the soil they are destroyed. Growth of the bacterial life is encouraged and a beneficial effect is produced on the growth of rice seedlings.

A study of the chemical changes during the process of the ripening of the Mango fruit.—*By* V. G. Patwardhan.

Harvesting and Ripening.—When the fruits begin to fall naturally from the tree which are known as "*Pad*" fruits the picking of mangoes for ripening is done.

The process of artificial ripening is a very simple one consisting chiefly of keeping the mangoes in a dark place, not much ventilated, piled in a heap (known as *Adhi*) in alternate layers of hay and green picked mangoes for a period of about eight days.

The temperature that is generated during the process of ripening in the pile (*Adhi*) increases regularly as the process continues and goes up to about 8 degrees higher than that of the room in which the pile is arranged; say from 28°C. to 39°C. The temperature above 36°C. is more or less fatal as the rotting increases.

Acidity which is present in unripe mangoes is reduced during ripening enormously as much as by 75 per cent, leaving about 25 per cent of the original in the fully riped mangoes.

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Sugars.—Both reducing and non-reducing are present in the mango in all its stages in very small amount in the unripe stage but in enormous quantities in the riped stage. The amount of reducing sugars is very small and more or less remains constant during the process of ripening nearly about 1 to 5 per cent. The amount of non-reducing sugars increases rapidly and in a ripe mango it varies from 55 to 65 per cent as calculated on the dry matter of the juice.

The 'Murda' disease of Chillie (Capsicum.)—*By* G. S. Kulkarni.

A very serious disease known as 'Murda' occurs on the chillie crop in the Bombay Presidency. It appears every year and does considerable damage to the crop. The disease begins in the crop at any stage of its growth, on the leaves of young shoots which get twisted and crumpled and much reduced in size. Later on the shoots dry up and the plants get blighted.

The disease is caused by the same mite which causes the Tambera disease of potato. The mite is also known to attack Zinnia plants. Like all other mite diseases it can be easily controlled by sulphur treatment. The mite belongs to a species of Torsonemedea.

Conditions influencing the distribution of Grain Smut (*Sphecelotheca sorghi*) of Jowar (Sorghum) in India.—*By* G. S. Kulkarni.

The Grain Smut (*Sphecelotheca sorghi*) of jowar (sorghum) although very common in the Presidencies of Bombay, Madras, Central Provinces, and Burma is rare in the Indo-gangetic plains. This rarity, from the germination study of the smut spores in the Laboratory, was found to depend upon temperature factor. The results of the experiments both in pot and field confirm this fact, namely that the temperature is the controlling factor in the distribution of the grain smut in India.

The Chromosome theory of inheritance in relation to economic plant breeding.—*By* F. R. Parnell.

General sketch of the chromosome theory of inheritance as propounded by Morgan and others.

Character determiners of *factors* are carried in the chromosomes of the germ cells. All the hereditary characters of an organism fall into linkage groups, one for each chromosome.

The chromosomes from each germ cell retain their individuality after fertilization and from generation to generation. Thus any two characters of the same linkage group that come from the same parent of a cross will show coupling in F_2, whereas if they come from opposite sides they will show repulsion.

A certain amount of crossing over may take place, i.e. interchange of segments of chromosomes during pairing in the reduction division, and this affects the degree of linkage exhibited.

The main theory agrees very well with the facts of inheritance as at present known and forms a very useful working hypothesis.

The bearing of this theory on economic plant breeding.

In dealing with a large number of characters linkage groups may be worked out and factors determining economic characters assigned to their respective groups. Such factors, though of considerable importance,

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may be difficult of recognition in themselves but, once they are assigned to a definite linkage group, they may be traced by means of visible characters with which they are linked. This is the old method of using correlations but worked on more scientific lines.

A knowledge of linkage relations frequently determines which plants are homozygous for a dominant character.

In building up desirable types difficulty will be experienced in combining two factors of the same linkage group from different parents. Failing a parent carrying both factors a *cross over* is the only possibility of the desired type coming pure.

Several linkage groups have been worked out in rice, the largest of which contains twelve or more factors.

The composition of the milk of some United Provinces cows and buffaloes throughout their period of lactation. —*By* P. S. MacMahon, B. M. Gupta and P. C Mukerji.

The results of over 1,000 analyses of milk from nine cows and nine buffaloes taken throughout their period of lactation are tabulated. The object of the work was to establish a reliable milk standard for the U.P. In the case of individual animals it is shown that very large fluctuations in composition occur without any appearance of regularity.

A further series of analyses extending over a year were done on mixed herd milk, both of cows and buffaloes, and the effect of seasonal change examined. The various empirical formulæ employed by analysis in other countries are tested and their applicability to Indian milk discussed.

Observations on the wilt disease of cotton in the Central Provinces, India.—*By* S. L. Ajrekar *and* D. V. Bal.

(1) Two strains of a Fusarium sp. have been isolated from wilted cotton plants and their causal connections with the wilt disease established in inoculation experiments.

(2) In addition to the usual Cephalosporium and Fusarium type of spores and chlamydo-spores, these two strains produce on culture-media sclerotium or perithecium-like bodies which enclose a cavity within a pseudo-parenchymatous wall. No kind of spores have, however, been observed either in or on these bodies.

(3) The two strains differ from each other only in one particular, the colour of the sclerotium-like bodies. It is dark blue or bluish green in one and whitish or pale-brown in the other.

(4) The behaviour of the two strains on media designed to ascertain their response towards the chief manurial constituents P_2O_5, N and K_2O and towards the plant juices of the susceptible Roseum and the resistant Buri varieties of cotton was studied.

(5) The reputed immunity of the Buri cotton was tested and confirmed.

(6) An attempt to ascertain if the wilting of the cotton plant was due to any toxins secreted by the fungus gave negative results.

(7) The feasibility of different suggested methods of dealing with the disease in the field is discussed in the light of the observations recorded.

A preliminary classification of the wild rices of the Central Provinces and Berar.—*By* S. C. Roy.

The economic importance of the study of wild rices is twofold: (i) they form an important weed in the rice growing areas of the Central

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Provinces and often cause heavy loss to the cultivators, (ii) they are a frequent source of contamination of the cultivated rices through casual mixture and natural crossing.

The varieties commonly met with in the Central Provinces have been described and an attempt has been made to classify them in order to facilitate their recognition in the fields. Characteristic features of the wild rices are (i) that they possess red grains inside the spikelets, (ii) they develop long stout awns which may be green or red, and lastly (iii) they allow their grains to fall off even when they are green and apparently not perfectly ripe.

Natural crossing has been found to take place in the wild rices to the extent of 7·9 per cent. Instances of crossing between plants with red and green leaf-sheath have shown that the red colour of the leaf-sheath behaves as a segregating character splitting in the Mendelian proportions of 3 : 1 with Red : Green. Occasionally however, a ratio of 9 : 7 of Red : Green has also been obtained but such cases were rather few, the 3 : 1 ratio being by far the more common.

Instances of crossing of 4 unit characters such as leaf-sheath red with spikelets clustered and leaf-sheath green with spikelets not clustered were also obtained giving all the 4 forms in different combinations.

The popular belief that a cultivated rice, if not looked after properly, i.e. with regard to transplanting, nursery sowing, etc., will become converted into a wild rice and vice versa, within 3 years, appears to be extremely doubtful. Wild rices have been grown on the Nagpur Farm for the last 7 years exactly under cultivated conditions, and yet they have retained all the habits and characteristics of the wild rices. The occurrence of certain wild forms mixed with many of the cultivated varieties suggests the occurrence of natural cross fertilisation between the wild and the cultivated rices.

The problems connected with the use of insect parasites in checking Insect Pests.—*By* M. A. Husain.

The fascinating idea of the control of insect pests of plants through the activity of their insect parasites has come to the forefront in the field of Agricultural Entomology. While, on the one hand, this line of attack is regarded as the surest, there are workers who doubt the efficacy of parasites in eradicating pests.

For the last few years the spotted bollworms of cotton have been experimented upon in the Punjab.

For a parasite to be effective it must have a much shorter life history as compared to its host, it must lay a very large number of eggs: these eggs must be laid on a large number of hosts, it must be capable of attacking the host in its very early stages, i.e. before the host has done very much damage, it is very important that it must be capable of "domestication" so that it can be breed in an insectory under artificial conditions and distributed.

Spraying in the Punjab.—*By* M. A. Husain *and* D. Nath.

It is usually asserted that in this country the time for resorting to operations like spraying has not yet come. The work in the Punjab has proved that the zamindars are anxious to take it up. Very successful spraying operations have been conducted on a large scale against Citrus Psylla and Mango Hoppers. The prices of fruit have gone up so much that it pays to spend money on controlling insect pests.

It is essential to provide facilities to the fruit grower and means of doing so are suggested.

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Studies on the decomposition of some common green manuring plants at different stages of growth in the black cotton soil of the C.P.—*By* D. V. Bal.

1. Observations on the rate of growth of *sann* hemp (*Crotalaria Juncea*) and *Dainchya* (*Sesbania Aculeata*) in black cotton soil show that the latter is a comparatively slow grower in its initial stages.

2. It is seen that as the green plants advance in age the proportion of leaf to stem decreases and the percentages of dry matter and fibre increase.

3. It is seen that the earlier *sann* is used as green manure the more rapid is the decomposition of its carbonaceous and nitrogenous constituents. With *Dainchya*, however, there was no marked decrease in the rate of nitrification of the comparatively older plants, though there was a certain amount of decrease in the decomposition of carbonaceous constituents.

4. Nitrogen in the leaves of *sann* hemp is more easily nitrofied than that in stems.

5. Stems of *sann* hemp do not appear to have any retarding effect on the decomposition of *sann* leaves in black cotton soil.

6. The slowness of decomposition in full grown green *sann* plants is not due to the increasing proportion of stems to leaves. It may be due to the change in composition of the plants and such alterations which take place in the physical condition of the plant tissues owing to a large reduction in the water content. Plant tissues partially dried owing to advance in age require time to absorb water from the soil and thus become susceptible to attack by soil micro-organism.

The mutual applicability of the analytical figures for butter, fat and ghee.—*By* F. J. Plymen *and* A. P. Padmanabha Aiyer.

1. Published analyses of ghee and butter prepared from the milk of Indian milch animals have not been always comparable as it was not known in every case how the samples were prepared.

2. In view of the fact that butter is prepared at a low temperature and ghee at a high temperature, the authors thought it desirable to prepare butter and ghee respectively from the same sample of milk. Following the Indian custom samples were also prepared after boiling the fresh milk.

3. The cream before churning was subjected to one of the various treatments following :—

(*a*) Unripened cream churned at once.
(*b*) Cream allowed to stand and then churned.
(*c*) Cream ripened with starter obtained from ordinary butter-milk and then churned.
(*d*) Cream ripened with an artificial starter and then churned.

These methods represent the processes generally used for butter making in India.

4. From the results obtained, it is apparent that the various methods of ripening the cream and preparing butter at a low temperature or ghee at a high temperature do not have any significant effect on the analytical figures which are usually taken as criteria of purity.

5. Determinations were also made on samples of butter fat which have been kept for 3 to 6 years and on ghee prepared from the same. It was again found that heating the butter fat to a high temperature as is necessary in the process of ghee-making does not materially affect the analytical figures or the conclusions which can be drawn from them.

6. The authors therefore conclude that the analytical figures published for butter fat are applicable also to ghee and vice versa.

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A note on the preliminary study of the use of karanj (Pongamia glabra) leaves as green manure for rice in Western India.—*By* D. M. Ranade.

Growing of green crops like Sunn (Crotolaria juncea) or Dhaincha (Sesbania aculeata) for green manure is impossible in the above tracts on account of either heavy monsoon in the beginning of the season or insufficiency of soil moisture, towards the close of the year; hence the available green stuff of nitrogenous character like Karanj leaves is suggested as green manure. Field experiments show that a profit of 15 per cent is gained by the use of these leaves if they are puddled in the soil before transplanting of paddy takes place.

With a view to ascertain if this green stuff can, with advantage, be treated previous to its application, laboratory work was taken in hand which shows that more than 33 per cent of the total nitrogen gets ammonified after the leaves have been steeped in water for a period of eight weeks. Field experiments will be conducted very shortly to see if the crop shows response to such treatment.

Speedy denitrification was confirmed, also, in the soil, so much so that after a week's time the nitrate added—more abundantly than the usual doses—left no residue of nitrogen either in the form of nitrate, nitrite, or ammonia.

Section of Physics and Mathematics.

President:—J. H. Field, M.A.

Presidential Address.

The Upper Air-Objects and Methods of Research in India.

When I was offered the privilege of presiding at the meetings of this Section of the Congress, I had misgivings in regard to my power of offering an address which should be of sufficient interest to maintain the high standard set by your past Presidents. On consideration, however, I concluded that, as the Science of Meteorology had during recent years attracted to its side physicists and mathematicians of eminence who were rapidly envolving order out of chaos, there was a reasonable presumption that Indian meteorology might prove a welcome subject for a part of your attention this year.

2. From earliest childhood we have been so accustomed to the vicissitudes of weather, that we have acquired the unconscious habit of taking them for granted: to most of us they have appeared as irresponsible as they are uncontrollable, and only to comparatively few has come a real curiosity with regard to the precise factors which govern weather. Nevertheless the last few years have seen a great change in the degree of general interest taken in meteorology, and this has been brought about mainly by the war. Modern artillery is capable of very great precision, but precision is thrown away without a knowledge of the effects of air-currents on the shell after it has left the muzzle of the gun, and these air-currents vary from day

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to day. It has come to be recognised, therefore, that an essential requirement in long-range gunnery is a knowledge of the winds and of air temperature, up to heights of at least eight kilometres, or five miles.

3. Then again there were in the war such matters as the safeguarding of aeroplane-pilots, the correct judging of the probability of winds favouring repulse of a gas attack, and the definite knowledge of the imminence of ground fog or of its coming dispersal: all these assumed an importance which led to the organisation of an immense system of meteorological observation extending from America, over the Atlantic, to France; while *in* France aeroplanes were set apart for the sole purpose of measuring continually the temperatures and pressures in the upper air.

4. The system of observation was served by coded wireless telegraphy, and as practically all information from the West, whence European weather largely comes, was necessarily hidden from the Germans, the enemy experienced a great handicap in many matters affecting warfare.

5. With the close of the war, public interest in these things has largely withdrawn itself, but the expert in gunnery and flying must always hereafter retain his sense of their importance; and I have recently had to pay attention to the meteorological needs of artillery practice camps, and to the wider requirements of civil flying schemes which would certainly benefit from an extensive system of air-current observing stations spread over the countries to be traversed.

6. The problems of to-day vary with the country presenting them. In Europe the Indian anxiety for rain does not exist, nor in India the anxiety regarding frost which in a single night can, in the West, ruin a season's crop of fruit. But whatever the problem, the conditions which will solve it are largely to be found in the upper air; and it was the impossibility of measuring these until a few years ago which handicapped the old-time meteorologist to an extent rendering much of his work ineffective. And that this handicap was severe can be realised when one remembers that nowhere throughout the lowest 10 kilometres of the atmosphere, in India at any rate, are the variations of condition so great or so rapid as within the first half-kilometre from the ground, so that the changes occurring at the surface form a very poor criterion for estimating those taking place in the main body of the air.

7. At the surface of the earth the old-time meteorologist could measure his temperature and pressure, his wind and humidity; but apart from the indications of cloud he had nothing to guide him in judging of the conditions prevailing in the great bulk of air above. At the ground we experience in this country during the hot weather the enervating heat of a layer of air which has altered its characters at a height of half a

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kilometre; and during the cold weather, with its rapid changes at the surface from the pleasantness of midday to the evening chill, we should at half a kilometre height enjoy an equable temperature throughout the twenty-four hours.

8. In regard to wind and humidity also, this lowest half kilometre commonly offers more rapid variations than any other corresponding thickness of the atmosphere; and the meteorologist in his measurements of wind is troubled by the effects of ground contours and surface friction, in his measures of humidity in India by the thirstiness of a dry soil.

9. These temperature conditions are illustrated diagrammatically in Fig. 1. Here we have variations in temperature

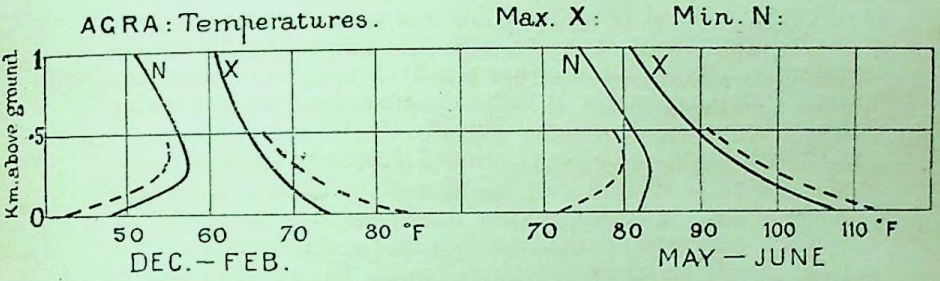

Fig. 1

(full lines show normals at ground, and approx. normals above: dotted lines show approx: extremes.)

between day and night at the ground-level in Agra *averaging* 25° F in the months of January and May, the hottest and coldest months of the year, and reaching well over 30° F on individual days; while at half a kilometre height, where vultures are soaring, the variations daily are only a few degrees, and the temperature is pleasant all the year round. Similarly with wind; a great but unknown increase in velocity very commonly occurs within this lowest layer, and the wind direction in its upper levels may differ radically from what it is at the surface.

10. But, however great an interest we may find in the conditions of this lowest portion of the atmosphere, the *practical* interests of our weather work go to higher levels; they deal with the air-stratum limited by a height not less than 15 kilometres above the surface, for it is within the whole of this region, but especially perhaps in its upper parts, that the physical conditions which intimately affect weather are to be sought.

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11. Before settling down, however, to our Indian problems and the methods of dealing with them, I should like to rise very much more rapidly, and for a few minutes invite your attention to the atmospheric features as far as the outermost limits of the sensible atmosphere, taking this 15 km. zone on the way. If we follow the air upwards through a range of many kilometres, the temperature, which has been falling more or less steadily to very low values, shows a sharp halt in its rate of fall, or in other words the temperature "lapse-rate" suddenly becomes practically zero.

12. This somewhat startling change was first observed in France and verified in Germany about thirty years ago by Teisserenc de Bort and Assmann respectively, who found that it occurred in the neighbourhood of 10 kilometres height; and it has been encountered since in all other countries where recording instruments have been sent high enough. Near the equator, on the Victoria Nyanza, it lies about 17 kilometres up, and from the equator it falls continuously with increasing latitude towards the poles, where there is some reason to think that it lies at a height of about 7 kilometres.

13. The change is not infrequently introduced by an actual inversion of the lapse rate, in the form of a small and abrupt rise of temperature, above which the gradient becomes so slight as to be practically zero up to the greatest height to which recording instruments have yet penetrated. Flights by instrument-carrying balloons have been very common up to 20 kilometres, and on rare occasions much greater altitudes have been reported, but in every case without showing any variation of the condition of nearly constant temperature. Beyond those great heights we have no certain knowledge of temperature, and it may well be that it remains nearly steady for some hundreds of kilometres, before beginning to fall towards the unutterable coldness of outermost space.

14. In the lower region, with its falling temperature, a region which has been called the troposphere in distinction from the stratosphere above it, the gases of the atmosphere are kept in a constant state of turmoil by winds, eddies and rising and falling currents; and consequently the mixing is so complete that samples of air taken at any height from ocean level to mountain peak, show when analysed a practically constant constitution except in regard to water vapour.

15. We have nitrogen and oxygen, of course, water vapour and carbon dioxide, as the chief constituents; but in addition there are many gases which do not directly call attention to themselves. There are ammonia, ozone, neon, argon, krypton and xenon; and there are the very much lighter gases helium and hydrogen. Of these, if we are looking for gases which form permanent constituents of the atmosphere, we must rule out ammonia, for it is brought down by the

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first shower of rain after its formation at the surface; and ozone, because its activity causes it a short life; and further it is believed for several reasons that we must rule out hydrogen. The gases neon, krypton and xenon on account of their high molecular weights, cannot be expected to occur in any quantity above the troposphere; for the stratosphere is in general a region of calms, floating quiescent, like oil upon water, on the turbulent troposphere beneath; and within it the gases are free, apart from the effect of diffusion, to separate out according to their relative densities. This they are believed to have done, and perhaps to have remained separated through all the ages; and although the boundaries between them will not be sharply defined, it is certain that the higher

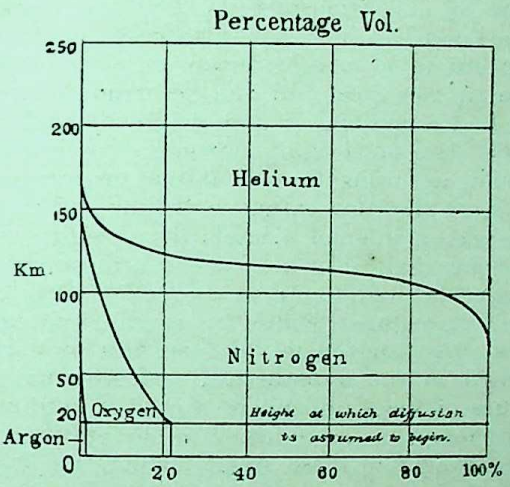

Fig. 2

the level at which a sample could be obtained the greater would be the proportion of its lighter gases. For the extreme upper air we are left therefore, with argon, oxygen, nitrogen and helium, and the distribution of these has been calculated by physicists. As a result it is believed that the composition is represented by the conditions of Fig. 2 which is a reproduction from a recent paper on the subject by Chapman and Milne.[1]

16. If a horizontal line be ruled anywhere on this diagram, the composition of the atmosphere at the height crossed by the line will be given by the intersections of the various

[1] "The atmosphere at great heights"; Q. J. R. Met. Soc., Oct. 1920, p. 379.

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curves with it. Thus at 20 km. the proportions of the gases present are :–

argon	..	..	..	1%
oxygen	..	..	..	21%
nitrogen	..	..	..	78%
helium	..	..	..	none

But if we pass to 100 km. we have cut out all the argon and most of the oxygen, and are beginning to get an appreciable quantity of helium. At 200 km. there is an atmosphere of pure helium, and this extends probably unalloyed into outer space. I say "probably unalloyed," because it has been suggested by Wegener, a German meteorologist, that a further gas, which he has named geocoronium, constitutes the outermost envelope of our atmosphere. This gas has not been traced in the lower air, but the hypothesis of its existence was put forward as a possible means of accounting for an unknown line in the green of the spectrum of the aurora ($\lambda = 5570$), and of supplying a gap in Mendelijeff's periodic table. It would be a monatomic inert gas of molecular weight 0·4, and should, according to calculation, be present at the earth's surface to the same extent as helium. But, and here is the crux, a gas of so small a molecular weight would have no chance of being retained in the earth's atmosphere. According to Jeans,[1] the high temperature of 740°C in the outer envelope would be required before the earth's hydrogen would be free to leave the atmosphere for ever, but for a gas of the molecular weight of the hypothetical geocoronium even the low temperature of the stratosphere would be high enough to allow complete escape in the course of a few centuries.

17. When we get to these great heights, the atmosphere is almost inconceivably attenuated, and it may interest you to see what the actual conditions are, according to the calculations by Chapman and Milne.

Ht. km.	Gr. per c.c.	Relative density.	Mol. per c c.
0	$12{\cdot}5\ 10^{-4}$	1	$2{\cdot}7\ 10^{19}$
20	$\cdot 88\ 10^{-4}$	$7\ 10^{-2}$	$1{\cdot}9\ 10^{18}$
800	$1{\cdot}75\ 10^{-17}$	$1{\cdot}4\ 10^{-14}$	$2{\cdot}7\ 10^{6}$

If we take the density of the air at the ground surface as unity, we must think of it as 10^{-14} at 800 km.; the atmosphere there is only a hundred-million-millionth part as dense

[1] Jeans, Dynamical theory of gases, 1904, p. 323.

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as that at the surface. The molecules down here have a mean free path of only about 10^{-5} cm., while at the upper height considered they have 1000 kilometres (600 miles) to travel on the average before they make a single molecular collision. One's first thought is that at those great heights, all physical considerations must cease to have a meaning, and that it would be mere pedantry to pretend that there is any atmosphere left; but this is not so, for although a molecule will on the average travel there for 1000 km, nearly the distance from Calcutta to Madras, before colliding once, there are still left nearly three million molecules to the cubic centimetre.

18. But let us now consider that part of the air which directly affects weather. The problem in India is Rain, and always Rain. For rainfall we depend upon a great depth of air of high humidity acted upon by some natural process of cooling, to squeeze out its moisture in liquid form. It will not help us to have the surface air at saturation point, if within half a kilometre of the ground a dry stratum succeed the wet one and continue upwards to great heights. It is equally of no use for even *saturated* air to extend upwards for many miles if there are no conditions of motion within it to cause dynamical or other cooling to the point of rain formation. We may recognize in the laboratory various methods of cooling; by conduction, radiation and intermixture, but in nature these are all negligible, from the point of view of rainfall, in comparison with the dynamical process of cooling by expansion. Conduction in the free air has no influence at all on the case; radiation is a slow process, and only appreciable when the overlying air is dry and therefore non productive; and intermixture, though it certainly *may* produce condensation, is seldom extensive enough in nature to show more than an insignificant effect. That *some* rain formation may occur follows from the fact that the capacity of air for water vapour increases much more rapidly than the temperature of the air itself, and that consequently if two masses of air, at or near saturation but at different temperatures, are forced to mingle, the resultant mixture may pass the saturation point corresponding with the new temperature of the whole. But that the effect must always be small can be seen by a numerical example; for ii we start with the somewhat extreme ease of two masses of saturated air, each mass 1000 metres high, and originally at temperatures 75° and 95° respectively, we shall extract from the hotter mass by its admixture with the cooler a fall of only 4½ cents of rain, out of its total water capacity of 34 times that amount.

19. Now instead of mixing our columns of air, assume that the column at 95° F is merely raised mechanically above the other column and extends from the 1000 m. level to something beyond 2000 m. It will then be found that the upper column will drop some 90% of all the vapour it holds, giving

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a shower of nearly 1½ inches of rain. This latter process has in fact been 30 times as effective as the former in rainfall production. Obviously then, the process of dynamical cooling is much more important in its bearing on rainfall in nature than any mixing of air which may take place in the atmosphere; and moreover it is a process which is constantly occurring wherever winds are blowing over rising ground, such for instance as in India from sea level to the Himalayas: we may regard it in fact at the *only* cause of effective rainfall in nature.

20. A body of air containing moisture, but still unsaturated, if raised from sea level through several kilometres in the atmosphere will begin to fall in temperature at the adia-

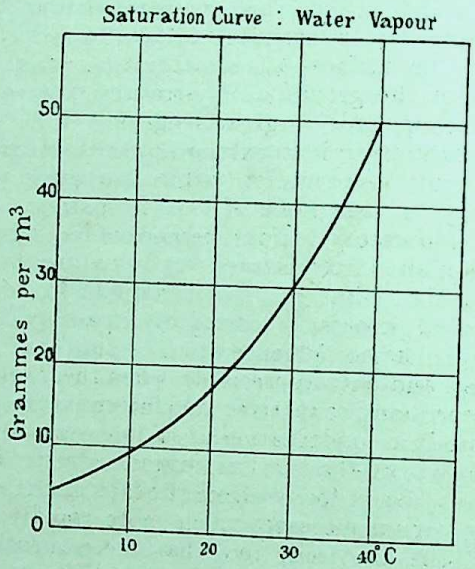

Fig. 3.

batic rate for dry air, which is about 1° C for every 100 m. of rise in height; and later, when its temperature has decreased sufficiently to let the saturation point be reached, any further fall will assume a rate which is governed also by the liberation of the latent heat from the water particles formed.

The diagram Fig. 4 shows these changes, and so long as the lapse rate does not exceed these values the condition is stable. But if for any reason, such as the heating of the ground by insolation, the lapse rate rises further, there will at once occur a tendency for upward convective currents to form. The result of unstable temperature gradients may be seen in India in the occurrence of dust-devils, dust-storms and thunder-storms, which

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concentrate over a restricted path the energy extracted from widespread areas of sun-baked ground; and, if water vapour is already plentiful, give rainfall which may be very heavy. Such weather disturbances are comparatively local, but from their violence draw to themselves an amount of attention which is commonly out of proportion to the degree of their irrigation effects. They may, and often do, result in great damage by the suddenness and violence of the rainfall accompanying them, but the energy they make use of is incomparably less than that involved in a gently raining sky well spread over

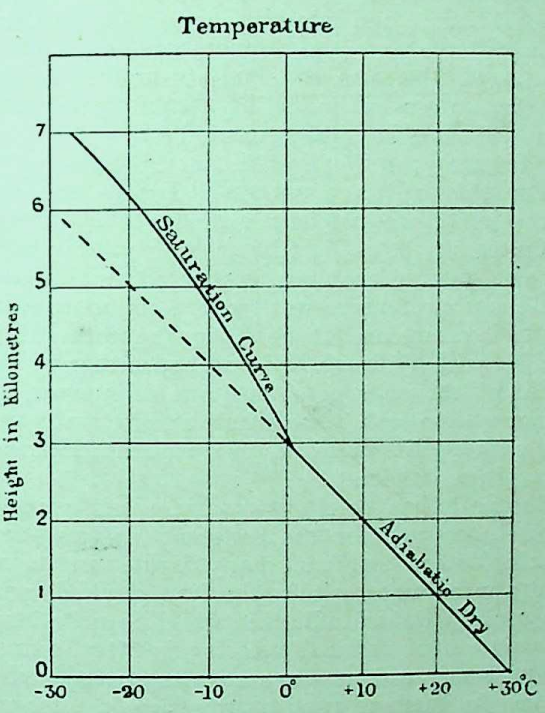

Fig. 4.

a province in a normal monsoon. However great, then, may be our scientific interest in dust and thunder storms and other such small producers of rainfall, we have to recognize that the direction of practical enquiry lies rather in the causes of variations in monsoon winds, cyclones and winter storms, and it is consequently to these that in India we have set ourselves in the first instance.

21. Our business, then, has been to measure and record as many of the conditions in the upper-air over India as have

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important bearings on weather: to do this at as many places as our financial resources will allow; and to use the results for formulating the normal state of the atmosphere. With normal information once gathered, we should be in a position to make an attempt at a physical interpretation of abnormal features subsequently observed, and with sufficient insight in the interpretation to increase the correctness of forecasts and extend their range.

22. For several years we have been measuring in India the strengths and directions of winds daily at a number of stations in plains and hills, mostly in the north, the range of measurement embracing all levels from the ground upwards to some 10 or 12 km.; and in addition we have measured, as far as our powers have gone, the temperature and humidity up to 10 or 15 km. at Jhang in the Punjab, and Agra in the U.P. You may be interested in having some details of the way these measurements have been carried out.

23. We may consider first the measurement of air movement. For this we have without expense the evidence of clouds, of which full use has been made by the old-time meteorologist. But cloudy days in India are few and far between, and cannot speak for more than very restricted zones of atmospheric levels: so that for intensive work we are bound to employ other means. Such means are at hand in the form of free-flying balloons filled with hydrogen and watched, either by two theodolites placed at the ends of a base-line of known length, and recording on a time-scale the altitude and azimuth observed, or by a single theodolite with an independent determination of the height of the balloon.

In Europe it has been customary, when using the single theodolite, to assume for the balloon's vertical velocity the normal value determined from many flights, and to regard the results as approximate within the limits which practice has shown to apply. But in India this would be quite inadmissible, for the variation of vertical velocity is often extreme, since upward and downward air currents are strong and frequent. Captain Ley in England used at one time to measure, by an adjustable eyepiece micrometer, the angular diameter of the balloon as it rose, and to deduce the heights therefrom; and in India we have applied this method in an improved form by inserting in the eyepiece a ruled micrometer scale, and reading upon it the angular measure of a tail, 100 metres long, hanging from the balloon.

24. The method of two theodolites is obviously capable of great accuracy; and, regarding that as a standard, we have taken many comparative observations of the alternative methods by using them simultaneously on a given balloon. As a result, the limits of accuracy of the single theodolite method are known to suit our present purposes with balloons, and as

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the method is the cheaper in operation, the major part of our work is carried out by its means.

The balloons are made of guttapercha tissue, of which a sample is on the table. This material was chosen after experiments had been unsuccessfully tried in Simla with a variety of fabrics, and after ready-made rubber balloons from Europe had proved unable to withstand the exposure of the journey out. The guttapercha is entirely satisfactory: it is light, weighing 24 grms. per square metre; nearly impervious to hydrogen; readily kept in good condition if stored under water in the dark, and is very easily made up into balloons by little-skilled labour.

In practice, such balloons are sent up once daily through-

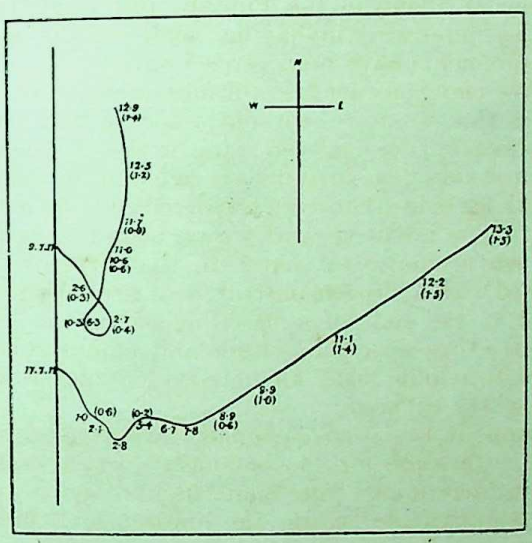

FIG. 5.

out the year at each observing station, and alternate readings of azimuth and altitude are recorded at half minute intervals, while the angular measurements of the tail base-line are taken at convenient time-intervals. The recorded values are worked out by mechanical means, devised for the purpose, to give the geographical positions of the balloon in relation to a N. and S. line passing through the starting point; and a trajectory, or plan-view of the balloon-course, is then drawn to a known scale. Two examples are shown in Fig. 5 from balloon records in Simla a few days apart, and from these it will be seen how great a change in direction of wind-currents can occur well up in the air, without any guiding sign of it near the ground. In the figure heights in kilometres are marked in non-bracketed numbers. From the trajectories precise measurements readily

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follow of the direction and velocity of the wind at any required level; and for purposes of preparing normal values of these elements, the flights are tabulated at regular half-kilometre intervals from the ground upwards, and are thereafter combined by mechanical means into resultant values for each level over half-monthly periods throughout the year.

In clear and cloudless weather we are able in India to follow a three-foot balloon to distances as great as 65 km. (40 miles), corresponding sometimes with vertical heights of 15 or 16 km., before it is lost to sight and measurements cease.

25. But a matter of more interest perhaps lies in the methods of recording by instruments the conditions of temperature and humidity in the upper air. For this purpose we may use free balloons with very light recorders, or, for small heights, kites controlled from the ground. Of the latter we have used in India mostly kites of the form shown in Fig. 6,

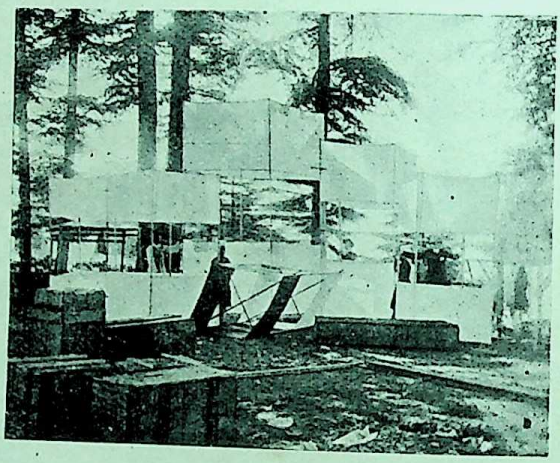

Fig. 6.

a form brought to high efficiency by Mr. Dines in England. The largest illustrated here was 15 feet high, while that most commonly used measured 9 feet, and weighed 13 lb. only. This smaller kite was capable of carrying out several miles of steel piano-wire from a winding machine and of rising in a strong steady wind to a height of well over a mile: several such kites could be attached in tandem, at intervals of a mile or so, to one tetherwire, with the recording instrument in the top one; and in Germany such a tandem arrangement has been coaxed to carry its instrument up to a height of four miles.

The use of kites like these is a matter of serious manipulation, and involves an engine to wind in the steel tether-wire;

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for they may together pull with a force of 200 pounds or more in a strong wind, and with adverse conditions may become unstable in flight and wreck themselves and their recorder in the air.

26. Various forms of recording apparatus may be used with these, one of which, the Marvin meteorograph of America is on the table On a clock-driven drum a paper chart is continuously written upon by four pens, marking the several meteorological elements. The instrument, which weighs only 1,100 grams (2½ lb.) is hung within the kite and freely ventilated by the wind which raises it.

A typical diagram from this instrument, obtained at Belgaum on August 29th during the monsoon of 1906, is shown in Fig. 7. Horizontal distances are proportional to time, and vertical distances to the elements measured, which, in order

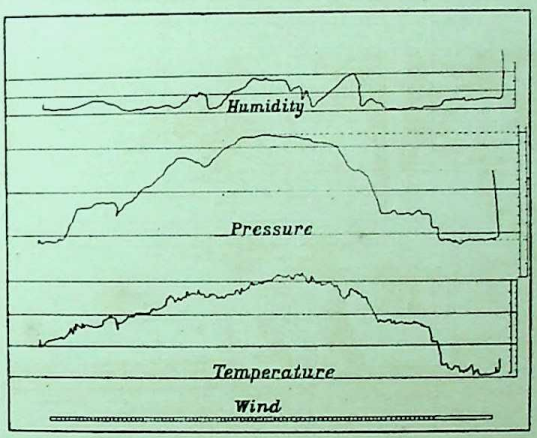

FIG. 7.

from top to bottom, are humidity, pressure, temperature and wind. This flight lasted five hours and the maximum height reached was 1½ miles.

The diagram when interpreted in accordance with the calibration of the instrument which drew it, results in the two higher curves of Fig. 8; while an earlier record of the same year, on May 28th when the monsoon was nearly due, provided the two lower curves of the same figure.

It will be seen that on this day in May, temperature fell off rapidly, but at less than the adiabatic rate, from the ground level up to 1000 m. while humidity increased steadily from about 60% at the ground to near saturation at the level of low-lying cumulus clouds. Just above the cloud level was encountered an entirely different current of warm and very dry air: that it was warm is shown by the inversion of the temperature

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curve, and that it was dry, by the rapid drop from near saturation to a humidity of 20%.

In the higher curves of August, three months later during a weak period in the monsoon, it is seen that the conditions were somewhat similar, but that the thickness of the lower damp and rainbearing winds had increased from 1,000 m. to over 2,000 m. Again there appeared above this current the rapid rise of temperature and the sudden fall in humidity to almost complete dryness; and it may perhaps be concluded that the main differences between premonsoon conditions and those of a weak and of a strong monsoon lie in the thickness of the damp sea-current which is being dynamically cooled on rising over the inland ground surface or on being forced otherwise to rise by confluence of currents. An interesting point

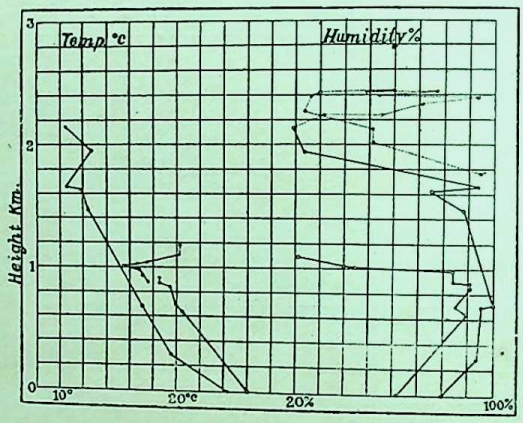

FIG. 8.

is the way the upper limit of the damp monsoon current repeatedly rose and fell through the kite in the course of the day, as shown by the dotted upper part of the humidity curve. It indicates that the rainbearing current, on that day at least, thickened up in the hotter hours and thinned down as evening came on, just as a "land and sea breeze" is known to do.

27. A kite which is out of adjustment, or flying in a wind too strong for it, is liable to dive and circle in the air, and will then give one a very anxious time. In each downward course it will pull viciously on its tetherwire and may break it; and on ascending on the opposite side of the circle will ride lightly with a nearly slack wire. The circle may have a diameter equal to or greater than the height of the kite, and in the latter case the result will be a complete wrecking

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of kite and recorder on the ground. Fig. 9[1] contains the record from a kite which is circling, and shows the motion clearly on both the pressure curve, giving height, and the temperature curve of the instrument. The largest circle shown is one of a mile in diameter, and in it the ground was evidently very nearly touched.

The arrangement of a recording instrument suspended inside the kite, convenient as it is, suffers from the disadvantage

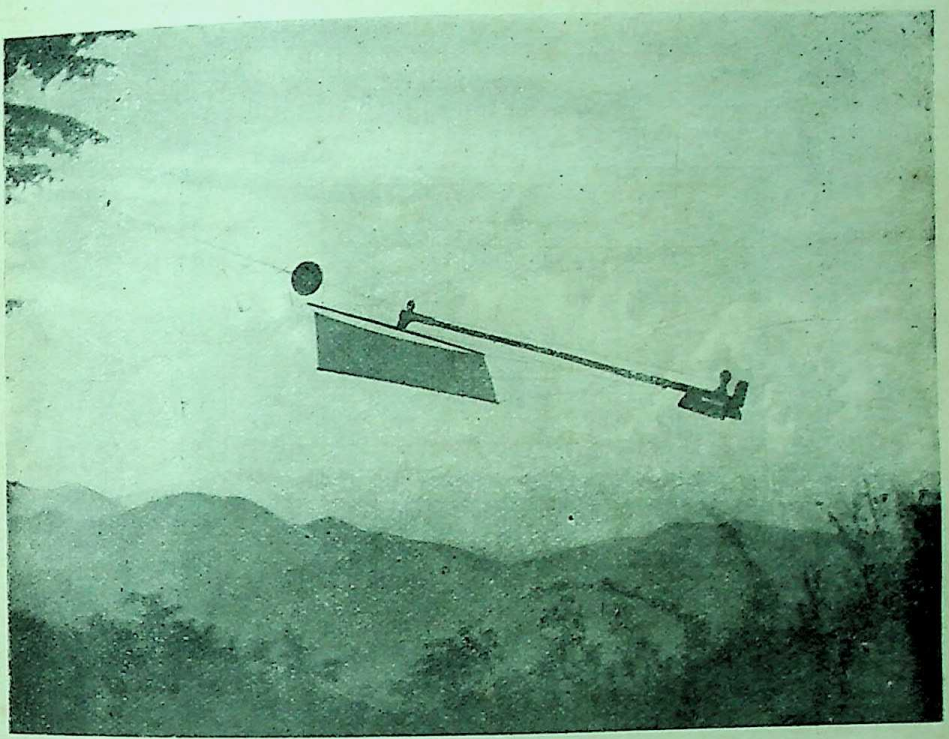

Fig. 10.

that since it may take some hours to coax the kite up to its highest point, and considerable time to pull it down by its engine, the records obtained from the instrument do not really represent simultaneous measurements throughout the air from the ground level upwards: the part of the record which applies to the air near the ground may in fact have been obtained on the ascent some two hours before that of the highest point reached, and this again an hour or more before the succeeding record in the lower layers during the process of winding in.

[1] Fig. 9 and several subsequent figures are omitted in this publication.

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28. To overcome this disadvantage in India, a recorder was devised which should be put into use only when the kite had actually reached its highest point, and then secure a double record from the ground surface up to the kite and down again within the space of twenty minutes. The arrangement is shown in Fig. 10. A lath of bamboo carrying a recording instrument at its lower end, and a sail at its upper end, is mounted to run on small wheels upon the kite-wire and is blown up it by the wind; when it has reached the kite, the sail is automatically detached and thrown away by a disengaging device actuated on impact between a trigger at the front end of the boom and an obstacle plate which has been fixed on the wire immediately below the kite just before its liberation.

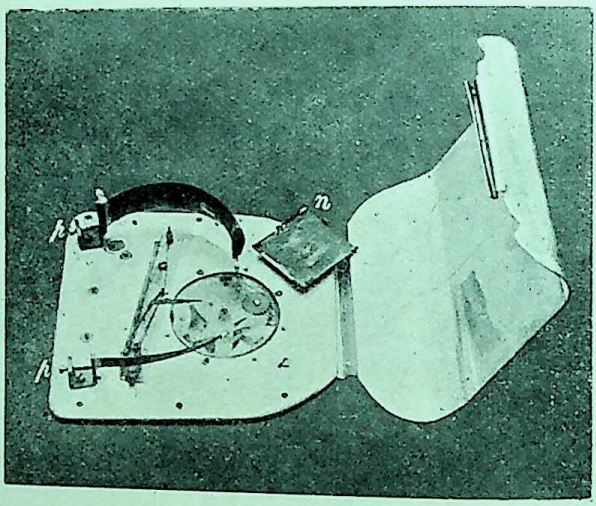

Fig 11.

The apparatus runs rapidly up the wire to the kite, throws away its sail on impact, and returning downwards by its own weight secures two nearly simultaneous diagrams of the conditions of pressure, temperature and humidity in the several air-layers at the time. The recording instrument is made mostly of aluminium and weighs 120 grams. Its record plate of thinly-silvered glass, is rotated by a watch and marked upon three steel pens which record the several elements. It is shown in Fig. 11.

29. Work with kites is expensive however, considering that the heights accessible by their means are very limited and dependent on weather, and for these reasons attention has for some years been directed to the use of cheaper methods of solving the problems in hand by the employment of free balloons

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carrying instruments which are made very light indeed. Fig 12 shows such a balloon six feet in diameter, partly filled with hydrogen and ready to be sent up with its recording instrument. The weight of a six-foot balloon of this material is about 250 grms. (½ lb.) and when it has filled itself out completely by the expansion during the ascent of its partial charge of hydrogen it has a free lift of about 3,000 grms. (6½ lb.) which is gradually lost by efflux of gas on further expansion as the balloon rises, until at some 18 km. (11 miles) height the balloon, with its load, floats in equilibrium, and is thereafter brought down by leakage or some automatic means of rupturing it.

30. Instruments of a sufficiently light type to comply

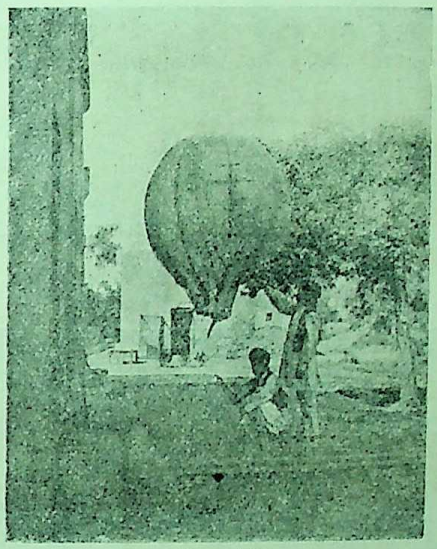

FIG. 12.

with the dictates of economy were first devised and made by Mr. W. H. Dines in England, and there is on the table an Indian-made example of his design Fig. 13a. It weighs 66 gr. (or 5½ tolas, slightly more than the English-made instrument), and it records continuously the pressure, temperature and humidity throughout the range of height traversed by the balloon. At the time when we in India began to pay attention to this method of experiment, Mr. Dines' instruments were not available for purchase and in making our own we adopted the ingenious principle of his recorder, at the same time trying still further to reduce the weight and so to diminish the cost of reaching a given height.

The result is shown in Fig. 13b and the instruments is on

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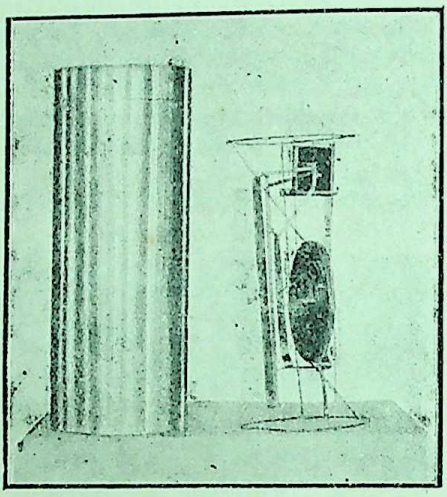
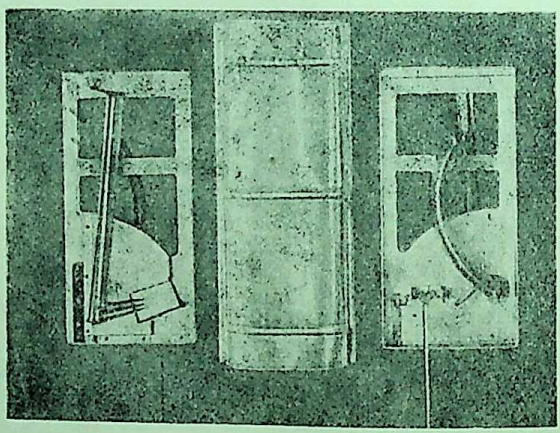
the table. It is made chiefly of aluminium, weighs 18 gr. ($1\frac{1}{2}$ tolas) and costs about Rs. 15 to make in Agra; and in common with Mr. Dines' recorder is capable of practically the same degree of accuracy in its measurement as those used on the



a.



b.

FIG. 13.

Continent of Europe, which cost about £30 each, weigh about 2 lb. and are correspondingly expensive to send up from the fact that they require comparatively large balloons to carry them. The Fig. 13b shows the front and back of the instru-

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ment inside, and the whole in its case. In the front view are seen the temperature and humidity arrangements, and the three steel pens which draw on a silvered glass plate the records of pressure, temperature and humidity. The temperature pen is actuated by the differential expansion of brass and invar-steel bars, and the humidity pen by the elongation and contraction of a sensitised human hair. In the back view appears the exhausted aneroid which, by actuating the pressure pen, gives a measure of the height reached at every point corresponding with the temperature and humidity records.

31. Each instrument before being sent up has to be calibrated: a very tedious process of going through the whole range of pressure and temperature changes likely to be encountered and obtaining autographic records of the corresponding responses. For pressure calibration the instrument is fitted with a clock-driven record plate; and for temperature is cooled in spirit by CO_2 snow in a Dewar's tube though a range of temperatures from that of the air down to $-80°$ C. Fig. 14 (omitted.)

The humidity calibration is comparatively simple, as saturation, complete dryness and several intermediate humidities are readily obtained in the laboratory.

Such a calibration is shown in Fig. 15 (omitted); it is taken on a silvered plate 1 cm. square, and has to be measured up under a micrometer microscope.

32. Fig. 16 shows the method of sending up the recorder. The instrument (a) is suspended in a light bamboo basket (b) which is fastened to a parachute (c) of silk, 14 inches square. This combination, with a total weight of 45 g. (4 tolas) inclusive of the instrument, is hung in loose engagement on a metal hook (d) attached to the "release" sail (f). During the ascent a downward current of air naturally blows upon (f) owing to the upward motion of the balloon, and the hook (d) thus retains its hold on the parachute; but when the balloon has reached its highest point, and by leakage or otherwise begins to descend, the air current becomes reversed, the release sail (f) flaps up and sets free the parachute with its instrument to descend independently to earth, where in most cases it is found and the reward for its return is claimed.

In countries where rubber balloons can be used the bursting of the balloon at extreme expansion can be relied on to bring down the instrument quickly, trailing behind it as a sort of speed-brake the ruptured rubber; but our guttapercha is non-expanding, and not being sealed will not burst, so that to effect this same purpose we paint several large spots of lamp-black varnish on the balloon. As long as upward motion continues the temperature of these black spots is kept low by the coldness of the air current, but as the ascent slows down the sun heats the spots, and they melt and empty the balloon

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This applies to day-light flights only, and at night we have to rely on mere leakage, and take the chance of the instrument drifting for very long distances, such as from Agra to Bengal, before it reaches ground.

The basket in which the instrument hangs effects the double purpose of protecting the instrument from rough handling by the finder, and of forming a conspicuous object to attract attention as it lies on the ground awaiting recovery. The latter purpose is helped by the small "twinklers" of tin-foil (gg) attached flexibly to the basket, as they blow about in the wind and scintillate in the sunlight.

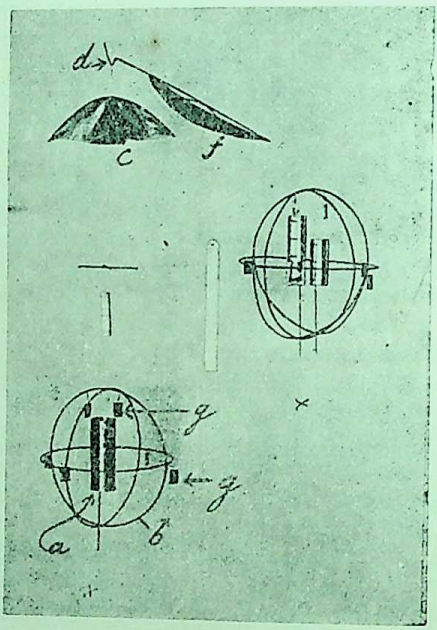

Fig. 16.

Fig. 17 (omitted) shows the return of an instrument sent up in Jhang, Punjab, by the finders, who have come in to claim the reward, which is announced on a label attached to the basket.

33. The results of these balloon flights can perhaps best be illustrated by a short series of enlargements from some of the original record plates. It will readily be understood that no retouching of the original is permissible in the case of scientific exhibits, so that no apology is necessary here for the blemishes inseparable from records which have gone through so strange an experience as these have, including the shock of reaching earth and subsequent handling by the finders. Photographic reproduction of the delicate originals is not an

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easy matter, for the silver on the plates has to be deposited in so light a film that there shall occur no such adhesion as could lead to stripping by the pens, and consequently the records are photographically thin and their enlargements weak.

34. The first[1] shows conditions in the cold weather, Jan. 25, 1917, when weather was dry and fine in Agra, but unsettled in the hills to the north. In this record it is clear that although the humidity at the ground was low, saturation was reached at the level where clouds might develop and result in wet weather. As a matter of fact rain fell two days later.

The second shows similar ground surface conditions at the same time of year, but with this difference above, that there is no indication of increasing humidity to bring its chance

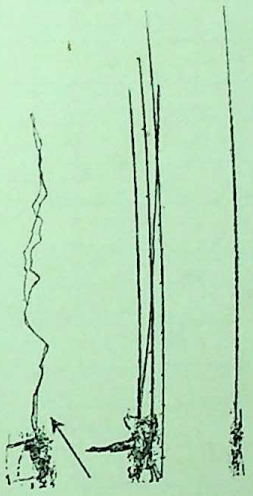

FIG. 23.

of rain. Weather remained dry during the ten days around this flight.

Feb. 16, 1917.—The next record is in mid-February, when weather had been dry everywhere for six days, and continued so afterwards for some time. The humidity trace shows at all heights an absence of the water vapour which is essential to rainfall production.

March 1, 1917.—Passing to March, we have in this record great dryness at the ground, but higher up there is ample material for rainfall. The weather had been dry for a week over north-west India, but proved wet on the following day.

March 13, 1917.—Compare with this the next record for a

[1] There were eight diagrams: only one is reproduced here.

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fortnight later, when weather was continuously dry for a long period. At the ground humidity is identical with that in the last case; but above it, complete dryness prevails, and nothing but fine weather could be expected.

June 14, 1916.—During the heavy rainfall of a strong monsoon over the whole country the record for June 14th, 1916, shows saturated air at the cumulus level, and again from 6 km. up to 8½ km. This is shown here in Fig. 23.

Oct. 2, 1915.—And lastly, in October, 1915, when on the 2nd of the month the monsoon was ready to pass away, though rainy weather still prevailed, a record showed saturation at the level of both lower and middle cloud; while at a later stage,

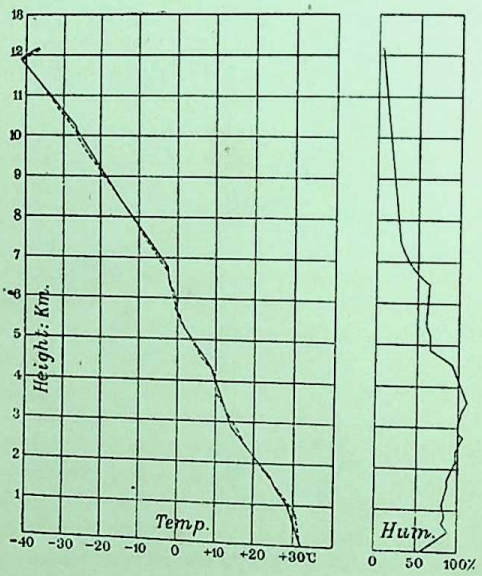

FIG. 26.

October 18th, the monsoon had disappeared from North India and humidity was very low throughout the atmosphere.

FIG. 26 shows a sample result of a balloon record, when interpreted by the calibration of the instrument. It indicates that humidity rises to saturation point, or near it, throughout a deep layer of air-from 2 km. to 4 km. above ground; and shows inversions of temperature at the 4 km. and 6 km. levels. In the temperature trace the dotted second line is the record of descent.

35. These are the more obvious features to be gleaned in a rapid glance at the records; but the temperature traces, with their varying gradients, give information as to season, and by

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their actual inversions show the superposition of air-currents which arrive often from very different sources. In none of these has the stratosphere been reached: it lies probably very high above Agra, as high perhaps, in the hot weather and monsoon as it does above the Equator, and our financial means have not admitted of touching it. In the cold weather, when the stratosphere might be accessible at less cost, the upper winds are so strong that instruments sent up to enter it would come down in Burma or Assam, and never be retrieved.

36. Mention has been made of the question of expense, but it is not to be inferred that with more money available, frequent occasion would be taken to reach the stratosphere: there are immediate and pressing needs lower down which would receive prior attention, and at present have to be neglected from want of means.

Very differently is the matter of expense considered in other countries. Germany, perhaps the thriftiest of European nations, has so strongly recognized the *practical* importance of upper-air research that for the last 20 or 25 years most liberal Government funds have been devoted to it, and in 1907, it was even thought worth while to equip a costly expedition to the Victoria Nyanza for experimental balloon work in German East Africa.

37. India is a country with more strongly marked meteorological features than any other perhaps in the world, and the solution of its rainfall problems is a matter of life and death to the Indian ryot: for scarcity is of yearly occurrence in some part or other of India, and the dread spectre of famine lies ever in wait for the ryot. Both scarcity and famine will have lost most of their terrors when we have reliable foreknowledge of a failing monsoon in regard to its geographical incidence, for timely remedial measures will then be possible. *But*, —there is the question of expense, and on this matter Sir Profulla Chandra Roy remarked to me on Monday last, that "The money is that of the poor Indian ryot." True, yet to the Indian ryot belongs also this great country and its weather, and Government is his Steward: it is our business in the ryot's interest to see that we obtain with all possible speed the power to forecast the Indian rains, both in the monsoon and in the cold weather, and accurately to foresee local disaster: the methods I have described will materially advance this purpose.

Were the ryot allowed to contribute, now, one-thirtieth of one anna per head for experimental work upon these problems, real activity would be possible, and who would then venture to say that in a few years' time the problems might not be solved? At our present rates of working, the ryots' contribution for settlement of these vital matters takes no less than some twenty years to amount to that one-thirtieth of one anna per head. We are doing all that is possible in the circumstances

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but our progress is very slow: for it is dominated by exiguous budgets.

Smell.—*By* E. R. Watson.

The investigation was undertaken with the object of finding a method to classify and describe smells in a scientific manner.

It was known that some odorous substances, e.g. hydrochloric acid and formaldehyde, form chemical compounds with proteids, and it was thought that the perception of odour might in all cases be due to chemical reaction between the odorous substance and the proteid of the olfactory organ. But no chemical reaction or even absorption was detected on shaking dry powdered albumen with alcoholic solutions of various odorous substances, e.g. ethyl acetate, citronellal, pyridine, acetic acid; nor was any evidence of chemical reaction obtained by determining the freezing point of aqueous ethyl acetate solutions before and after addition of uncoagulated white of egg.

On the other hand, a close connection has been established between the odour of substances and the surface tension of their aqueous solutions. It was found that a consistent measure of the intensity of the odour of a substance was given by the strength of the most dilute aqueous solution of the substance in which the odour was perceptible. And it was found that the intensity of the smell was proportional to the depression of the surface tension of water by the odorous substance.

As was expected on theoretical grounds it was also found that the intensity of smell was proportional to the absorption of the odorous substance from aqueous solution by animal charcoal.

Services with regular increments of salaries.—*By* K. B. Madhava.

With respect to maintaining in Government service an establishment up to a certain strength, under regular increments of salary by time scale, the questions as to the number of annual recruitments, number superannuated, total amounts paid to officers and pensioners, as salaries and pensions, etc., are answered, under suitable hypotheses, by mathematic formulæ involving the ideas of Life contingencies.

The Orthoptic Loci of Algebraic Curves.—*By* A. N. Rao.

The paper aims at studying the singularities of Orthoptic loci and thus bringing under the purview of a general theory, all the scattered results about the orthoptics of particular curves. Singularities both of "ordinary" curves and of others specially related to the circular points are studied in detail. There is a section on the Degeneracy of the Orthoptic, and another on the inverse problem of the determination of all primaries having a given curve for their Orthoptic loci. The paper concludes with some interesting applications to envelopes.

The principle of Döppler and the time perspective.—*By* S. C. Kar.

In this paper a proof is attempted of the exact law of spectral displacements in relative motion. It is thus shown that the usual statement of the principle of Döppler which associates spectral displacements with the existence of a relative velocity is generally erroneous. A remarkable result is deduced by integration which shows that all observed binary and other stellar periods where the spectrum reveals a shift of the lines should be corrected for the illusion as to time-flow caused by radial motion.

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The kinetic theory of solids and the partition of thermal energy.—*By* B. M. Sen.

The kinetic theory of gases has been developed by many well-known physicists, but little progress has been made on that of the solids. Recently, however, Nernst and others have developed the subject on Planck's hypothesis. In the present paper the subject has been treated on the basis of classical mechanics.

Attempts have been made to explain the specific heat of atoms on the hypothesis of the equipartition of energy. It is known that for 1°C rise of temperature, each atom of most elements absorb 4×10^{-16} ergs in round numbers. Each atom having six degrees of freedom, half of the available energy is absorbed by the translational motion

$$[\text{cf. } \tfrac{1}{2} mv^2 = a\theta \text{ where } a = 2{\cdot}02 \times 10^{-16}]$$

while the other half is absorbed by the motion of rotation. But the specific heat of most elements increases gradually with the temperature, whereas the degrees of freedom can only increase by leaps. It may be noted that the hypothesis is fairly satisfactory for gases.

In the present paper, from known values of the specific heats and compressibility, the dimensions of the molecules have been determined and also the intermolecular forces. The gain of energy per molecule (for 1°C rise of temperature) is split up into three portions: (1) that absorbed by the translational velocity which increases the external energy; (2) that absorbed in doing work against the inter-molecular forces; (3) the third portion being absorbed by the molecule itself and may be explained by the absorption by the electrons. Those three portions are calculated and the mathematical analysis is worked out in detail.

This result is considered important, being a direct negation of the Principle of Equi-partition of Energy.

Note on the criterion that two samples are samples of the same Population.—*By* P. C. Mahalanobis.

1. The classical method consists in comparing the Mean values m and m', of the two samples, and finding the probablity of the difference m-m' (as measured in terms of its probable error). This method neglects altogether any difference in the general nature of the two distribution of frequencies.

2. Pearson's Coefficient of Contingency. The two samples are compared group by group, and their independence is measured by the probability (P) of χ^2, a certain defined function of the two series of frequency groups.

If $n_1, n_2, n_3 \ldots\ldots$ total N.
$n_1', n_2', n_3', \ldots\ldots$ total N'.

be the two series of actually observed frequency groups,

then $$\chi^2 = NN' S \frac{\left(n/N - n'/N'\right)^2}{n+n'} \ldots\ldots\ldots (A).$$

3. In the first part of the present paper, the above two methods are compared, with special reference to anthropological data. It is shown that the second method (contingency coefficient) is the more appropriate method for the purposes of comparing different samples.

4. It is noted, however, that two difficulties arise in applying formula (A) to the case of small samples.

(i) The values of n and n', the group frequencies, depend to a considerable extent on the system of grouping adopted.

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Thus with the same unit of grouping, different values of χ^2 are usually obtained.

(ii) With different units of grouping, the different values of P may differ quite appreciably.

5. Both of these difficulties arise from the large fluctuations inherent in random sampling, especially in the case of small samples. Numerical examples show that samples of 100 or 200 (in the case of anthropological data) are not large enough to avoid appreciable fluctuations due to random sampling.

6. In the present paper it is proposed to substitute n, n', the *observed* frequencies, by m, m' the corresponding *graduated* frequencies. It was found that this led to a considerable improvement in practically every case considered so far (i.e. in about 20 different numerical examples).

7 This procedure also affords certain mathematical advantages. In many cases it is possible to find a suitable analytical expression for m and m'. In anthropology, m and m' are usually given (at least to a first approximation) by the "normal" (Gaussian) curve of errors.

In this case it is possible, under certain conditions, to replace $\phi^2=\chi^2/(N+N')$, by a definite integral. The solution has been discussed in detail. The subject of integration may become infinite along certain tracks: with exception of such special cases, it seems that the new formulae may be of some use in obtaining quickly the appropriate value of ϕ^2.

Binary Commutative Algebras.—*By* R. Vaidyanathaswamy.

1. *General Theory.* A binary commutative linear algebra in two units e_1, e_2, is completely defined by a multiplication table of the form :—

$$e_1^2=\lambda_1 e_1+\lambda_2 e_2\ ;\ e_1e_2=\mu_1 e_2+\mu_2 e_2\ ;\ e_2^2=\nu_1 e_1+\nu_2 e_2.$$

The algebra is of rank 3, the identical equation satisfied by any number, $x=x_1e_1+x_2e_2$ being $x^3-x^2L(x)+xD(x)=0$ where $L(x)$ and $D(x)$ are absolutely covariant linear and quadratic forms in x_1 x_2 Writing $x^2=f_1(x)e_1+f_2(x)e_2$, the form $f(x)\equiv x_1f_2-x_2f_1$ is also a covariant of the algebra. Every covariant of the algebra is shewn to be a covariant of the binary forms f and L. In particular the absolute invariants of the algebra are obtained as the ratios $\Delta:\Delta_1:\Delta_2$, where Δ is the discriminant of f, $\Delta_2=(f, L^3)^3$, $\Delta_1=(H, L^2)^2$, H, being the hessian of f. Two algebras with equal, finite absolute invariants are equivalent under linear transformation of units.

2. The following special algebras are discussed : (*a*) Singular algebras ($f, D,\ L\equiv O$) ; (*b*) Nilpotent algebras of rank 3, ($D,\ L\equiv O$); (*c*) Unitary algebras ($f=o$) ; (*d*) Null algebras ($D=o$) ; (*e*) Normal algebras ($L=o$) ; (*f*) Algebras with a principal unit ; (g) Primitive algebras.

The following theorems are proved :—

(1) The necessary and sufficient conditions for a principal unit are (1) $f_1D\not\equiv O$; (2) D is a factor of f ; (3) the remaining factor of f is not a factor of D.

(2) The only algebras of rank 2 are (*a*), (*c*) and (*f*).

(3) The only associative algebras are (*a*), (*b*) and (*f*).

3. For all the above special algebras a certain invariant Δ^3 vanishes. Representing every algebra-type by a point in a plane with homogeneous co-ordinates,=the invariants Δ, Δ_1, Δ_2, the algebras for which $\Delta_3=0$ are represented by a cusped cubic with cusp at Δ, inflexion at Δ_2, the cuspidal and inflexional tangents meeting at Δ_1. Let R be the point on this cubic corresponding to the algebra with a

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principal unit; let the tangent at R meet the curve in P and the tangent at P meet the curve in Q. Then it is shewn that (1) P corresponds to the Null algebra; (2) Q corresponds to the primitive algebra; (3) the lines PQ, PR represent the factors of the Resultant of f and D.

A new method of determining "H."—*By* W. A. Jenkins.

The principal of the method is that of the production of an artificial magnetic field by means of an accurately wound solenoid—the artificially created field being adjusted to bear a known ratio to the earth's field. Two methods are described. In both methods a small magnet is suspended at the centre of the solenoid, and is observed by means of mirrors attached to it. In the first method the solenoid is set at right angles to the earth's field and the current adjusted until the deflection is 45°. A measurement of the current and the constants of the solenoid then gives a measurement of "H." In the second method the solenoid is set accurately parallel to the earth's field. An external bar magnet in the Tangent "B" position of Gauss then deflects the suspended magnet. The deflection is measured. A current is now sent through the solenoid to produce a field 2H opposite to the earth's field. The field is 2H when a similar deflection is caused by the external magnet. The deflection must of course be approximately 45°. As in the first method the measurement of the current together with the solenoid constants gives a value of H.

The accuracy of the method is discussed and it is shown that it is as accurate as the Kew Magnetometer method, and easier to carry out.

On the colours of Mixed Plates and other Optical Investigations.—*By* C. V. Raman.

1. In this paper, a general account was given of a number of optical investigations recently carried out by the author in association with his research scholars. In each case, observations were described which showed that the theory of the phenomenon hitherto accepted is either incorrect or inadequate, and a new treatment was suggested to explain the observed facts.

2. The colours of Mixed plates.—This well-known phenomenon, which was studied by Thomas Young and Brewster, has in more recent times been explained by Charles Fabry and R. W. Wood on the basis of the elementary theory of laminar diffraction. Observations show however that there are a number of features in the phenomenon which the treatments proposed by Fabry and Wood fail to explain. The most important case is that of a mixed plate of uniform thickness through which a distant light-source is viewed. The author has shown that the characteristic features of the halo observed round the light-source can only be explained by taking into account the peculiar form of the laminar diffracting edges present in the film. Owing to the action of surface-tension the edges are drawn inwards into the shape of a meniscus and hence scatter light in an unsymmetrical manner. The quantitative development of this theory gives results in complete agreement with observation.

3. The Colours of Breathed-on Glass Plates.—This beautiful optical phenomenon was explained by Karl Exner and by Donle, who however held divergent views regarding its nature. The author has found that the explanations advanced by these writers must both be rejected. The real element of regularity which gives rise to the observed colours is neither in the size of the water-drops nor in their arrangment, but in the angle of contact between liquid and plate.

4. The Colours of Ammonium Chloride films.—This case is in several respects analogous to the one just mentioned.

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5. Newton's Diffusion-rings and Quetelet's Phenomenon.—The explanation usually advanced of this phenomenon is that the light, regularly transmitted through the film covering the mirror at entry and diffracted at emergence, interferes with the light diffracted at entry and regularly transmitted at emergence. In actual practice, however, the diffracting film is often a thin irregular lamina completely covering the surface of the mirror, and hence the diffraction must be assumed to occur both at entry and at emergence. The modifications of the theory necessitated by this are supported by the experimental results obtained by the author.

A fuller account of these investigations is appearing in the Philosophical Magazine.

On the Characteristics of Indian Stringed Instruments.—*By* C. V. Raman.

In this paper, attention is drawn to the remarkable results produced by the special form of bridge used in the Indian "Tamburn" in which the matal strings pass over the curved surface of a wooden bridge, and an adjustment is provided for varying the contact of string and bridge by silk or woolen threads slipped in between them. It is found that the Young-Helmholtz law, according to which the harmonics having a node at the plucked point are not elicited, is completely set aside as the result of this arrangement, and a complete and powerful retinue of overtones is actually manufactured by the intermittent contact of string and bridge. With proper adjustments, a fine quality of musical tone results.

The elements of discomfort indoors in hot climates: *discussion* inaugurated.—*By* E. P. Harrison.

A theoretical examination was made of the conditions as regards temperature prevailing inside an enclosure roofed and possessing a ceiling, the roof being exposed to the sun's rays during the day. It was concluded that the temperature of a body inside a room depends on :—

(i) the temperature of the external roof covering;
(ii) the material and condition of the surfaces, inner and outer, of the external roof covering;
(iii) the material and condition of the upper and lower surfaces of the ceiling.

Hence the best practicable roof was shown to consist of bright corrugated iron sheet supported on battens, several feet below which is a ceiling of wood painted white on both sides with silicate paint (lead paints are bad in hot climates since they are good radiators).

It was then pointed out that some experiments made by Mr. Dorman in Lahore strongly confirmed these theoretical conclusions which are in direct conflict with those leading to the accepted type of mud roof for dwelling-houses in the Punjab. In fact, the mud roof is almost the worst type for a really hot climate. Radiation plays such a large part in contributing to human discomfort in hot climates that much greater effort should be made to reduce it than has hitherto been customary. The bearing of Leonard Hill's work on his Kata-thermometer in measuring human discomfort when the enclosure is above the body temperature was referred to. Experiments are in progress with the object of separating the measure of direct radiation given out by roof and walls from the effect of conduction, convection and evaporation at the body surface.

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The influence of forced vibration on the true magnetism of the nickel coherer.—*By* S. S. Mukherjee.

By placing two magnetising coils parallel and perpendicular to the earth's magnetic field, and by adjusting two fixed and one movable secondaries in them, the effect of the mangnetising field (H) is eliminated and the true magnetism ($4\pi I - NI$) of the nickel coherer is ballistically measured.

The coherer is longitudinally vibrated by means of an electric tuning-fork and its true magnetism is studied under two conditions:—

(1) Vibration superposed on constant field.
(2) Change of field superposed on uniform vibration constantly acting.

1. Vibrations successively impressed increase $4\pi I - NI$ (by about 2%) up to a steady maximum. This change is nearly permanent: it persists for a very long time and can be carried over and superposed on the inductions at different fields. Reversals along with lowering of the field bring about the "recovery."

Temperature and packing remaining constant, the increase in ($4\pi I - NI$) due to vibration is (i) directly proportional to the field (H) in which the coherer is vibrated; (ii) inversely proportional to the least time (T) of vibration necessary to bring about this increase.

Vibration decreases the retention, the coercivity and the area of a $\frac{4\pi I - NI}{H}$ cycle.

2. Vibration, constantly acting, remarkably lessens time-lag and hysteresis. The true magnetism ($4\pi I - NI$) more readily and more quickly follows any change in the magnetising force.

The symmetry of $\frac{4\pi I - NI}{H}$ curves.—*By* S. S. Mukherjee.

This paper describes an interesting relation observed in $\frac{(4\pi I - NI)}{H}$ curves in the case of the ferromagnetic substances studied, namely that the area is proportional to the product of the retention and the coercivity.

Recent advances in seasonal weather forecasting.—*By* G. T. Walker.

The author describes the recent results of his extended examination into the correlation connecting Indian rainfall distribution with such physical elements as may be supposed to exercise a control. By means of curves of actual rainfall distribution and the factors as recognised in 1908, and now in 1920, he shows the great improvements which have matured from his work in the interval, and finally draws attention to the very material aid afforded by the Upper Air Observatory at Agra in preparing forecasts of the cold weather rains of northern India.

Notes on some newly designed physical apparatus.—*By* S. N. Maitra.

The paper contains an account of further work that has been carried out at the Bengal Engineering College, Sibpur, in the way of designing and making physical instruments. At the last Congress a paper containing a short descriptive account of twelve pieces of apparatus, specially designed for lecture demonstration and use in elementary practical classes in physics, was submitted by the author. In this paper he suggests that the manufacture of scientific instruments might

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be taken up with advantage by well-equipped colleges in India for inter-collegiate supply, and that the saving thus effected might be utilized profitably in importing instruments of precision only from abroad. A description and sketches of the following instruments are given and the instruments themselves exhibited :—

1. A mechanical model illustrating the formation of images by reflection from a plane mirror.
2. A mechanical model for verification of the law of refraction.
3. A new mercury reversing key.
4. Three varieties of apparatus to show that pressure at any point inside a liquid depends only on the head of the liquid.
5. A model compensated pendulum.
6. A demonstration apparatus for radiation and absorption.
7. A modified form of Puilinger's apparatus for finding the expansion of rods.
8. A modified hypsometer.
9. A modified Berthelot's apparatus for determination of the latent heat of steam.

Section of Chemistry.

President :- Dr. H. E. Watson, D.Sc.

Presidential Address. (See *Journal Indian Institute of Science*, Vol. IV, pp. 223–239.)

Alcoholysis of esters of saturated and unsaturated acids. —*By* B. Dasannacharya *and* J. J. Sudborough.

The authors describe experiments on the relative rates of alcoholysis of esters of certain saturated acids and the esters of the analogous $\alpha\beta$-unsaturated acids using hydrogen chloride as catalyst. The method adopted was a dilatometric one and the experiments were conducted in an electrically regulated thermostat kept at 30°

The results prove that an $\alpha\beta$-olefine linking in the acyl portion of the ester molecule has a retarding effect similar to that observed in the catalytic esterification of acids and in the hydrolysis of esters by mineral acids. The reactions studied were :—

(1) Methyl butyrate + Ethyl alcohol → Ethyl butyrate + Methyl alcohol.
(2) Methyl crotonate + Ethyl alcohol → Ethyl crotonate + Methyl alcohol.
(3) Methyl β-phenylpropionate + Ethyl alcohol → Ethyl β-phenylpropionate + Methyl alcohol.
(4) Methyl cinnamate + Ethyl alcohol → Ethyl cinnamate + Methyl alcohol,

and the corresponding reverse reactions.

Additive compounds of meta-dinitrobenzene.—*By* D. D. Karvé and J. J. Sudborough.

Symmetrical trinitro-benzene forms additive compounds with aromatic hydrocarbons, phenols, phenolic ethers, arylamines of different types and cyclic nitrogen bases. A series of experiments has been carried out in order to ascertain whether the same types of compounds also combine with *m*-dinitrobenzene. The results indicate that, as a rule, aromatic hydrocarbons, phenols and phenolic ethers do not form additive compounds with the dinitrobenzene ; the only exception to this rule so far met with has been the hydrocarbon acenaphthene. Arylamines, e.g.

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aniline, naphthylamines, etc., form definite compounds, but the introduction of negative substituents into the aniline molecule tends to inhibit the formation of compounds. Mixed alphyl-aryl secondary and tertiary amines also yield additive compounds, but diarylamines of the types diphenylamine and phenyl-naphthylamine do not. Cyclic bases such as carbazole, phenylacridine, substituted pyrazolones, quinoline, tetra-hydroquinoline and carbostyril do not yield additive compounds, whereas 3-aminocarbazole, *o*-and *p*-aminoquinoline combine with *m*-dinitrobenzene.

The compositions of the additive compounds are exactly analagous to those of the trinitrobenzene additive compounds, but their colours are, on the whole, somewhat paler.

Experiments on sandalwood oil.—*By* B. Sanjiva Rao, J. J. Sudborough *and* H. E. Watson.

Numerous experiments on the effect of sunlight and boiling water on Sandalwood oil have been made.

Samples of the dry oil were: (*a*) exposed to bright sunlight; (*b*) exposed to diffused light; (*c*) kept in a dark room during several months and the variations in (*a*) solubility in 70 per cent alcohol, and (*b*) optical activity determined. Samples in amber coloured bottles were also exposed in a similar manner. No alteration in optical rotation was observed in any of the bottles and only in the colourless bottles exposed to bright sunlight was a slight dimunition in solubility observable.

Briggs (J. Ind. Eng. Chem. 1916, *8*, 428) has shown that prolonged boiling with water produces a change in rotation from-20·7 to-13·3°.

A repetition of Brigg's experiments has shown that not only does the rotation alter but that the solubility in 70 per cent. alcohol decreases to a marked extent, although the percentage of alcohols, calculated as santalol, $C_{15}H_{23}.OH$, does not diminish. It is probable that the changes are due to the conversion of a portion of the β Santalol [$\alpha_D = -42°$] into α santalol. [$\alpha_D = +2°$].

The relationship between iodine values and refractive indices of hardened vegetable and animal oils.—*By* J. J. Sudborough, H. E. Watson, K. Pandurang Rao, D. Y. Athawale, D. V. Chandorkar *and* K. P. Karup.

Ubbelohde and Svanoe (Zeitsch. angew. Chem., 1919, *32*, 277) have drawn attention to that fact that during the gradual reduction of any particular oil, e.g. cotton seed or whale oil, there is a fixed relationship between the iodine value and refractometer number of the oil. The determination of the refractive index or refractometer number of a hardened oil is therefore an indication of the degree of reduction if graphs shewing the relationships between iodine values and refractive indices for different oils are known. Such graphs have been drawn for the following oils:—Cotton seed, ground nut, honge, mohwa, gingelly and sardine. In most cases the graphs are practically straight lines and those for cotton seed oil and mohwa oil are identical.

Some experiments on oil splitting by castor seed lipase. —*By* J. J. Sudborough, H. E. Watson, Itteyarah Joseph, K. R. Narayanaiyer, S. Palniyandi Pillay *and* K. R. Rama Iyer.

Various experiments have been made with a ferment obtained by grinding decorticated castor seeds with acetic acid, washing with water, pressing through cloth and filtering.

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Experiments have also been made in order to determine whether the free acids present in most crude vegetable oils are able to replace the accelerator—acetic acid or manganous sulphate—usually necessary when acid free oils are hydrolysed with crushed castor seeds or Nicloux' ferment.

Studies on the dependence of optical rotatory power on chemical constitution Part III:—*p*-naphthalene-bisimino-camphor—an instance of an optically active substance possessing the highest rotatory power.—*By* B. K. Singh.

This investigation deals with the preparation and rotatory power determination of 1 : 4-naphthalene-bisimino-camphor, which is endowed with a far higher rotatory power than any compound hitherto known, as shown in the following table:—

$[M_D]^o$	In chloroform	Methyl alcohol.	Ethyl alcohol.	Pyridine.
1 : 4-naphthalene-bisimino-camphor ..	8175°	9052°	12071°	13416°
p-phenylene-bisimino-camphor (the highest hitherto known)	6096	5009	5289	6173
Difference ..	2079	4043	6782	7243

Researches on porphyroxine.—*By* Jitendra Nath Rakshit.

The methoxy group in porphyroxine has been determined, and its metho-salts and salts of its acetyl derivative have been prepared.

Estimation of mercury fulminate in detonator compositions.—*By* M. L. Dey.

1. The defects of the existing methods are pointed out.
2. An improved method of estimation is described.

Preparation of β-3 : 4-dinitrodimethyl-aniline.—*By* P. S. Varma.

β-3 : 4-Dinitrodimethyl-aniline was prepared by Swann (J. C. S. T., 1920, 117, 1-4) by nitrating *m*-nitrodimethyl-aniline in certain concentrations of sulphuric acid and using the requisite quantity of nitric acid of a definite concentration. There results the β-modification in addition to 3 : 6-dinitrodimethyl-aniline first obtained by Romburgh (Rec. trav. chem. 1887, 6, 250).

The new method of preparing this β-modification of the 3 : 4-dinitrodimethyl aniline consists in treating the sulphuric acid product of dimethyl-aniline with nitrous gases at a temperature below 0°C. If the temperature is not allowed to rise, a good yield of the product is obtained, otherwise the yield is very poor.

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Studies relating to the bacteria associated with rice and other cereals.—*By* Gilbert J. Fowler *and* D. L. Sen.

The researches summarised in the following abstract originated through a request received from the Indian Munitions Board to investigate the bacterial factors of influence in the manufacture of starch.

This, in the first place, meant the determination of the sources of infection in a starch factory and of the conditions which might lead to fermentation and consequent loss of starch.

From the examination of the conditions of sterility arose naturally the special investigation of the more resistant organisms of which the bacillus employed by Weizmann for the production of acetone and butyl alcohol from starch was the most interesting.

The discovery that this bacillus survives the ordinary methods of cooking rice is of dietetic and possibly pathological importance.

The experiments may be described under the following heads:—

I. Bacterial factors in starch manufacture.
II. Sterilisation of grain.
III. Conditions of sterility of cooked rice.
IV. Conditions of starch fermentation, with special reference to the acetone fermentation.

I. Bacterial factors in starch manufacture.

Investigation showed that the principal source of infection in the case of starch-containing grains was the grain itself. Rice, ragi, jawar, wheat and maize were examined.

It was found that paddy, in common with many other seeds, carries a small quantity of saccharine mucilage which serves as a nidus for bacteria. On the other hand, in confirmation of recent researches by Hofmeister (Bio. Chem. Zeitsh, 1920, 218-225), an alkaloid has been found to be present in unpolished rice which probably acts as a selective antiseptic and protects the starch from bacterial attack.

Pure starch is not readily attacked by bacteria from the air. If however incipient germination of the grain occurs, sugar is formed and bacterial invasion and consequent further decomposition readily takes place.

II. The sterilisation of grain.

The sterilisation of the grain was attempted by both wet and dry processes.

In the wet process solutions of copper sulphate, chlorine water and sulphurous acid were tried.

In the dry process chlorine, sulphur dioxide, ozone, carbon dioxide and naphthalene were employed.

The dry process was found to be more efficient and convenient than the wet process, and of the dry processes the use of sulphur dioxide was the most practicable. Carbon dioxide has little antiseptic effect.

Sulphur dioxide, under the conditions employed, had the effect of inhibiting germination which from the point of view of starch manufacture is an advantage.

In connection with the storage of seed grain, however, further investigation on this point is desirable with a view, if possible, of adjusting conditions, so that the bacteria may be eliminated and the germinating power left intact.

The effect of ozone was encouraging in this connection, but only one experiment was tried.

The general question of the relationship of the presence of bacteria to the germinating power remains to be examined.

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III. Conditions of sterility of cooked rice.

In view of the resistant character of the organisms occurring on rice and the great importance of rice as a food, a bacterial examination of rice cooked under various conditions is of special interest.

Marked differences were observed between the behaviour of polished and unpolished rice.

Polished rice slowly fermented even after heating for 20 minutes at 15 lb. pressure, unpolished rice was completely sterile after heating for the same time at 10 lb. pressure.

When cooked at atmospheric pressure for 20 minutes polished rice goes bad after 48 hours while unpolished rice remains sweet for 72 hours.

Microscopical examination showed that polished rice carried many more organisms and of greater variety than unpolished rice.

The presence of a natural antiseptic on unpolished rice would thus seem confirmed.

IV. Conditions of starch fermentation with special reference to the acetone fermentation.

In view of the publication of the recent American Patent No. 1315585 by Weizmann detailing his method for isolating the acetone bacillus from maize, it was of interest to see whether this organism occurred on Indian paddy.

Weizmann's method briefly consists in making successive sub-cultures from an original unsterilised mash of grain into a sterile mash maintained for one or two minutes at 90°C.

Operating in this way a very fair acetone fermentation was obtained after 9 sub cultures.

At the same time it was noted in the course of the experiments on the sterility of cooked rice that the samples which had been exposed to the highest temperature without sterilisation developed the pleasant smell on subsequent spontaneous fermentation.

This would indicate that the isolation of an active acetone producing organism by successive sub cultures is really a selective process rather than the acquirement of new characteristics by the organism in the course of generations.

The bio-chemistry of the indigenous indigo dye vat.—*By* Gilbert J. Fowler *and* M. Srinivasiah.

The indigenous method for dyeing with indigo consists briefly in adding to the dye bath containing an alkaline emulsion of indigo a quantity of the seeds of "Cassia Tora" which have the property of setting up a fermentation, resulting in the reduction of the indigo to indigo white. The yarn is then immersed in the bath and exposed to air when the indigo white is oxidised to indigo blue, the yarn thus dyed is wrung out, washed and dried.

The object of the investigation, the results of which are here shortly summarised was to determine the nature of the fermentation set up by the seeds, with a view to the scientific control of the process.

The following are the main directions of the work:—

(1) Chemical examination of the seed.
(2) Study of the bacteria occurring on the seed.
(3) Study of the fermentation under special laboratory conditions.
(4) Study of the fermentation under conditions occurring in practice.

1. The seeds had a high nitrogen content (1·9 per cent) partly present in a sulphur protein recognised by the evolution of H_2S on fermentation and by actual estimation.

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The seeds are coated with a mucilage, a galactan which on acid hydrolysis yields glucose and galactose and some pentoses.

There is also a bitter principle of an antiseptic character contained in the seeds.

2. The seeds are found to carry bacteria which are able to ferment the mucilage with evolution of hydrogen. This hydrogen in the nascent reduces the indigo. The mucilage has the further property of forming an emulsion with the indigo, thus holding it in suspension and facilitating its reduction.

The bitter antiseptic principle appears to exercise a selective action so that only a few varieties of bacteria occur on the seeds.

The bacteria will grow on a starch medium, e.g. potato, but in absence of nitrogen such a growth will not ferment a sterile decoction of the seeds.

3. A number of experiments with pure cultures were tried using along with finely suspended indigo, seed decoction, potato, glucose and ammonium phosphate, also glucose and ammonium phosphate together with a little agar to help the suspension of indigo.

With glucose very good results were obtained especially in presence of a little ammonium formate; with potato there was loss of indigo and with the seed decoction the results were not in any way better than in the vat under normal conditions.

4. With the assistance of Dr. Marsden, small dye vats were made up and worked under normal conditions except that in one a pure culture was used and the conditions maintained as free from extraneous infection as possible. Little if any advantage, however, was found over the vat as commonly used, owing doubtless to the selective action of the antiseptic substance occurring on the seeds. A sample of the contents of an indigenous dye vat sent from Madura showed indeed little difference in bacterial content from a specially inoculated laboratory vat.

A study of the changes taking place in the vat showed however the necessity for providing nitrogenous food for the bacteria, as in its absence the indigo is attacked and considerable loss may take place.

Experiments on the utilisation of megasse.—*By* GILBERT J. FOWLER *and* BHOLANATH BANNERJI.

At present "megasse," the residual substance of sugarcane left after expression of the juice, is chiefly utilised as fuel. It contains some amount of unexpressed sugar as well as material hydrolysable to sugar, together with resistant fibre.

The experiments, the results of which are summarised in the following abstract, were undertaken with the object of obtaining power alcohol from the sugar and saccharifiable matter and fibre suitable for paper making from the residue.

Preliminary experiments showed that dilute sulphuric acid was a better hydrolysing agent than either dilute sulphurous acid or sodium bisulphite. Owing to its corrosive action hydrochloric acid could not be employed satisfactorily in the apparatus available.

The general method followed was to heat the material in a lead or earthenware container placed inside an ordinary copper or iron autoclave.

Among the different factors conditioning hydrolysis the following have been studied:—

(*a*) Variation of pressure and corresponding temperature from 20 lb. to 65 lb. per sq. inch.
(*b*) Variation of time of cooking from zero minutes to 5 hours.
(*c*) Variation of the time of preliminary heating up to the necessary temperature from 1 to 3 hours.
(*d*) Concentration and percentage of the hydrolysing acid.

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The best conditions for hydrolysis are an acid strength of from 0·35 per cent to 0·5 per cent, and a ratio of acid to fibre not exceeding 6 per cent of the weight of the fibre. A larger proportion of acid tends to destroy the fibre and to produce non-sugars which interfere with the subsequent operation of fermentation.

The maximum yield was obtained in 15 to 30 minutes, but there was not much loss when the heating was prolonged to 2 hours. The apparatus available did not permit of the pressure being raised beyond 65 lb. to the square inch. Published results (cf. Simonsen and Kreisman, Zeit Angew Chem., 1898, J.I.E. Chem. 1914) indicate that the yield of sugar increases up to 7½ atmospheres, so that the present experiments may be looked upon as giving yields below the maximum possible.

The best results are obtained when the material is heated up as rapidly as possible to the required temperature and as quickly as possible cooled, so as to minimise the destructive effect of the hydrolysing acid on the fibre.

The highest total percentage of sugar recovered was 36 per cent when 65 lb. pressure was used. Of this percentage about 6 per cent was originally present and about 30 per cent is produced by the hydrolysis of the non-fibrous cellular tissue of the megasse.

The saccharine solution obtained was not readily fermented by itself, even after clarification with lime. However a large percentage of it can be fermented when diluted with an ordinary fermentable solution of sugar.

The conditions of fermentation are being carefully investigated, both chemically and bacteriologically.

The fibres obtained under favourable conditions of hydrolysis of megasse can be pulped by heating under pressure with caustic soda and then form quite satisfactory material for making the cheaper and thicker grades of paper and for mixing with better grades of pulp, e.g. from linen and cotton rags.

Some experiments on the use of antiseptics in connection with the manufacture of glue and gelatine.—*By* Gilbert J. Fowler *and* K. C. Srinivasan.

The experiments referred to in the present abstract were undertaken with the view of finding a suitable antiseptic for glue and gelatine solutions which may be liable to contamination in the course of the manufacturing process.

Such an antiseptic besides being cheap and inoffensive must be efficient in quantities which will not at the same time affect the properties of the glue or gelatine.

The general method of experiment was to inoculate a number of tubes of gelatine with a culture of a liquefying organism and to add to a series of inoculated tubes gradually increasing quantities of the antiseptic under investigation. The tubes were kept during the day at room temperature (30–32°C.) allowed to set over night in a cold incubator at 20°C. and their appearance and particularly their order of melting noted the next morning when exposed to the room temperature.

The following antiseptic agents were used, hydrochloric acid, sulphuric acid, sulphur dioxide, phenol and formalin.

Of these sulphur dioxide offered the most advantages. It was found that an addition of sulphur dioxide giving an acid reaction equivalent to N/8(x 0·03) inhibited the activity of the bacteria without any deleterious effect on the gelatine. This will require about 0·75 gram of sulphur to be burnt for every kilo of the final product.

Besides its antiseptic effect, sulphur dioxide has the further property of acting as a clarifying and decolourising agent.

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A preliminary note on the constituents of *Pogostemon parviflorus*, Benth.—*By* D. B. LIMAYE.

A crystalline substance has been obtained by distilling the leaves of *Pogostemon parviflorus*, Benth, with steam, the mean yield being 0·11 per cent on the green leaves.

The substance melts at 107°–108° and a 10 per cent solution in alcohol gave a rotation of +14° in a 1 dm. tube. Analysis leads to the formula $C_{10}H_{14}O_2$, but the substance has not been identified with any known compound. It yields a dibromo derivative melting at 104°–105°. The name "Pangli Camphor" is suggested.

"Corchorin", a glucoside from jute leaf.—*By* HAVIDAR SAHA *and* KUMUDNATH CHAUDHURY.

A white crystalline glucoside has been extracted from the leaves of *Corchorus capsularis*. The melting point is 175—175 and the optical rotation —23·6°. The formula is shown to be $C_{22}H_{38}O_8 . H_2O$.

Studies in substituted quaternary azonium compounds containing an asymmetric nitrogen atom. Part IV. Additive compounds of thiocarbamide with azonium iodides.—*By* B. K. SINGH *and* MIRI LAL.

It is found that substituted quaternary azonium iodides unite with thiocarbamide in the molecular ratio of 2 : 1 as in the following cases:—

$[(C_6H_5)\ (CH_3)\ (C_2H_5)\ (NH_2)\ NI].\ C_2S_2N_4H_8.$
$[(C_6H_5)\ (CH_3)\ (C_7H_7)\ (NH_2)\ NI].\ C_2S_2N_4H_8.$
$[(C_6H_5)\ (C_3H_7)\ (C_7H_7)\ (NH_2)\ NI].\ C_2S_2N_4H_8.$

Phenylallylylbenzylazonium iodide forms a monothiocarbamide compound:

$[(C_6H_5)\ (C_3H_5)\ C_7H_7)\ (NH_2)\ NI].\ CSN_2H_4$

Phenyldimethyl and phenyldiethyl compounds do not unite at all with thiocarbamide.

New methods of extraction of caffeine from tea dust.—*By* N. R. CHATTERJEE.

A description is given of three methods of extracting caffeine from tea dust. (*a*) Extraction with water, treatment with litharge, evaporation and percolation with hot kerosine oil. (*b*) Treatment with milk of lime, drying, and percolation with hot kerosine oil. (*c*) Treatment with milk of lime, drying and extraction with cold fusel oil.

Mercuric sulphate as an analytical reagent in organic chemistry.—*By* S. C. CHATTERJEE.

The paper describes some reactions between some of the more common organic acids of the calcium chloride and ferric chloride groups and a solution of mercuric sulphate in dilute sulphuric acid and points out the importance of the latter as an analytical reagent.

Note on the citrates of calcium and strontium.—*By* K. P. CHATTERJEE.

$Ca_3(C_6H_5O_7)_2 16H_2O$ is precipitated when strong solutions of sodium citrate and calcium chloride are mixed. It is jelly-like, hygroscopic and readily soluble in water. It passes rapidly into $Ca_3(C_6H_5O_7)_2 6H_2O$.

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$Ca_3(C_6H_5O_7)_2 6H_2O$ separates in the cold with increasing rapidity up to 70°C. Warmth converts it into $Ca_3(C_6H_5O_7)_2 4H_2O$.

$Ca_3(C_6H_5O_7)_2 4H_2O$ gets precipitated at temperatures above 70°C. Its solubility decreases with temperature.

$Ca_3(C_6H_5O_7)_2 1\frac{1}{2}H_2O$ is obtained when any calcium citrate is heated to 110°C. With water it rehydrates to $Ca_3(C_6H_5O_7)_2 4H_2O$ with evolution of heat.

Analogous to the jelly-like calcium citrate, the hexa hydrate, and the tetra hydrate, a jelly like strontium citrate, a penta hydrate and a monohydrate, with almost similar properties, have been obtained.

Some induced reactions.—*By* N. R. Dhar.

(*a*) A solution of mercuric chloride can be reduced by oxalic acid, tartaric acid, etc., in the dark only by the action of oxidizing agents like $KMnO_4$, $K_2S_2O_8$, etc.

(*b*) The oxidation of solutions of sodium arsenite, sodium formate, sodium oxalate, sodium nitrite and ferrous ammonium sulphate by atmospheric oxygen can be induced by the simultaneous oxidation of sodium sulphite, stanuous chloride, manganous hydroxide, cobaltous hydroxide, acetaldehyde, formaldehyde, benzaldehyde, etc., by air.

(*c*) The decomposition temperature of potassium chlorate is appreciably lowered by the presence of decomposing ammonium dichromate or persulphate.

(*d*) It seems probable that one chemical change will either induce or promote another chemical change of the same nature.

(*e*) In oxidation reactions, the phenomenon of negative catalysis is possible only when the negative catalyst is liable to be oxidized readily.

(*f*) A ferrous salt acts as an inductor in the reactions between mercuric chloride and an oxalate or a tartate or a citrate.

Studies in ionic adsorption.—*By* N. G. Chatterjee.

The action of chemically pure hydrated manganese dioxide as an adsorbent has been observed in the case of a large number of electrolytes. The following results have been obtained :—

(1) The cation is much more adsorbed than the anion.
(2) The process of adsorption is very quick and the temperature coefficient is extremely small.
(3) Relatively more is adsorbed from a dilute solution than from a concentrated one.
(4) Non-electrolytes that decrease the surface tension increase adsorption.
(5) The atomic proportion of the bivalent ions adsorbed is the same for those electrolytes which have the same degree of ionisation at the same dilution.
(6) Freundlich's simple law of adsorption is more or less obeyed.

Some methods of sugar analysis.—*By* Ramji Narain.

The author proposes some modifications in the methods for use in the estimation of sucrose and reducing sugars.

1. The cuprous oxide obtained by the reducing action of sugars on Fehling's Solution can be very conveniently and accurately converted into cupric oxide by heating the Gooch crucible containing it in the muffle furnace for 45 minutes. The asbestos used in the crucible should be specially prepared according to the directions given.

2. Sucrose can be estimated in its mixture by inverting it with 10 per cent citric acid and heating over the water bath for 12 to 15 minutes after it has attained the temperature of the bath. The methods so far recommended (using acids for inversion result in the partial destruction

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of either fructose or both glucose and fructose. The modification proposed is free from these defects.

3. Clerget factor for the inversion of cane sugar has been redetermined for the mercury arc lamp light for concentrations up to 15 per cent. The value obtained varies from 142·55 to 143·0.

Condensation of 1 : 3-Diketohydrindene with Aldehydes. —*By* A. K. Das *and* S. C. Chatterjee.

The paper describes some new products obtained from diketohydrindene and aldehydes with dry hydrogen chloride as condensing agent. The substances separate in a very pure form and the yield is quantitative. It is suggested that as this process is capable of general application for the condensation of these substances in equimolecular proportions, it may be preferred to the ordinary method of heating, especially in view of the tendency towards self-condensation of diketohydrindene at a high temperature. It has also been pointed out that with the use of suitable solvents, these products can be isolated even at ordinary temperature, but then the tendency appears to be more towards the condensation of two molecules of diketohydrindene with one of the aldehyde.

Phenanthra-naphthazines.—*By* S. B. Dutt *and* A. C. Sircar.

The paper records the preliminary results of an investigation undertaken with a view to prepare azines by the condensation of substituted phenanthraquinones with 1 : 2-naphthalenediamine in the hope that the azines so obtained will have interesting dyeing properties. The following phenanthra-naphthazines have been described 2 : 7-and 4 : 5-dinitro, 2 and 4-mono-nitro, 2 : 7-dibromo, 5-bromo-4-nitro, bromo-dinitro, dibromo-nitro, 2 : 7-and 4 : 5-diamino, 2 and 4-amino, 2 : 7-and 4 : 5-dihydroxy, 2 and 4-hydroxy, 2 : 7-dianilino, 5-anilino-4-nitro, dinitro-anilino, dianilino-nitro-phenanthra-naphthazines, 5-sulphonic acid derivatives of 2 : 7-diamino, 2-amino, and 2 : 7-dihydroxy pharanthra-naphtha zines and naphtho-flavinduline.

The nitro and bromo azines, owing to their insolubility in ordinary solvents, are not suitable for dyeing. The hydroxy and amino-phenanthra-naphthazines dye wool yellow to brown shades and the anilino compounds yellowish green to bluish-green shades. The sulphonic acid derivatives are soluble in water and dye wool brown shades.

Preparation of organo-magnesium compounds without the use of ether.—*By* P. Neogi.

Tscheliuzeff prepared organo-magnesium compounds without ether by using tertiary amines as catalysts, the amines forming at first tetra-alkyl or -aryl compounds which react with magnesium to form organo-magnesium compounds liberating the free amines. In this paper it has been shown that these compounds may also be prepared in neutral solvents by the use of trialkyl-sulphonium iodides as catalysts. For example, using minute quantities of triethyl-sulphorium iodide organo-magnesium compounds have been obtained with methyl, ethyl, propyl, iso-butyl and iso-amyl iodides, the reaction being analogous to that observed in the case of tertiary amines.

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Section of Zoology.

President :—Dr. F. H. Gravely, D.Sc.

Presidential Address.

In opening the sittings of the Section of Zoology at this, the eighth Indian Science Congress, I propose to give a short account of the history of zoology in India and Ceylon. Parts of the subject have already been dealt with in the Centenary Volumes published by the Asiatic Society of Bengal in 1886 and by the Indian Museum in 1914, in Dr. N. Annandale's "Recent Advances in our knowledge of the Freshwater Fauna of India"[1] and in the history of Indian Ichthyology which formed Dr. B. L. Chaudhuri's presidential address to this section of the fifth meeting of the Congress.[2] These works, and others to be referred to later, have greatly facilitated my task and will supply many facts of interest that can be used to fill in the outlines of this brief sketch of the field as a whole. I am also indebted to Dr. Annandale, for calling my attention to several points that I had at first overlooked.

The earliest reference to Indian animals familiar to a Westerner is, I suppose, the mention of ivory, apes and peacocks brought to King Solomon once in three years by the navy of Tarsish which he had at sea with the navy of Hiram, King of Tyre.[3] A search through ancient Indian literature would doubtless reveal many other early references; but this is a subject on which it would be unnecessary to dwell here even if I had the requisite linguistic qualifications; for "the importance of these enumerations" as regards fish, Dr. Chaudhuri has told us, "is purely historical and the records do not actually lead us towards the advancement of our knowledge of Indian Ichthyology"; which appears to be equally true of other branches of Zoology. Even the veterinary hospitals recorded to have been founded by the Emporer Asoka have, I am informed, left no record of observations made upon their patients.[4]

The history of Indian Zoology may then be said to date from the captivity of Robert Knox in Kandy, which extended from 1659 to 1679. Knox had accompanied his father, a Commander in the East India Company's service, on a voyage to Madras, and thence to Ceylon, whither they were sent partly to trade, but chiefly to repair a mast that had been cut away in a storm at Matlipatam. While the repairs were in progress Robert Knox, his father and fourteen others were captured and

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[1] *Journ. Asiatic Soc. Bengal*, VIII, 1912, pp 39–53.

[2] *Journ. Asiatic Soc. Bengal*, (N.S.) XIV, 1918, pp. cxxxviii–cl.

[3] Kings, 22.

[4] An annoted list of the "Animals in the Inscriptions of Pyadasi" (= Asoka) by Monmohan Chakravarti has been published in the *Memoirs of the Asiatic Society of Bengal* (Vol. I, pp. 361–374, 1906).

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taken to Kandy. "This was probably," he says, "on account of our neglect, viz. in not sending a letter and present to the king at our first coming, who, looking upon himself as a great monarch, as he is indeed, requires to be treated with suitable state."

During his captivity Knox lived by keeping pigs and fowls, and by knitting caps; and he eventually became intimately acquainted with the characteristics of the kingdom. After twenty years he succeeded in escaping, and in 1681 with the encouragement of the East India Company he published his "Historical Relation of the Island of Ceylon in the East Indies," the sixth chapter of which gives an illustrated account, "of their Beasts, Tame and Wild, and Insects" and the seventh "of their Birds, Fish, Serpents, and Commodities." In these chapters he gives among other things an account of the Elephant, with the methods of catching it and the uses to which it is put, illustrated by a quaint picture of "An Execution by an Elephant"; he gives figures of two types of monkey (*Temnopithecus* and *Macacus*); he describes and records the habits of six kinds of ants (including termites); and he carefully distinguishes between the three different kinds of honey bee (*Apis dorsata, A. indica and A. florea*) found in Ceylon.

No further attention appears to have been paid to Zoology in Ceylon till 1821, nearly a century and a half after the appearance of Knox's book, when John (younger brother of Sir Humphrey) Davy, an Army Surgeon, published his "Account of the Interior of Ceylon and of its Inhabitants, with Travels in that Island," including a chapter on snakes and the land leech. Figures of several snakes are included, as well as an account of experiments with their poison.

In 1851 J. W. Bennett published "A selection of Rare and Curious Fishes found upon the Coast of Ceylon: from drawings made in that Island and coloured from life—With letter-press descriptions." In 1852, E. F. Kelaart, again an Army Medical Officer serving in the Colony, published his "Prodromus Faunae Zeylanicae" and Mr. E. L. Layard of the Ceylon Civil Service commenced a series of contributions to the *Annals and Magazine of Natural History*. To Kelaart, who was a Dutch Burgher, belongs the destinction of being the first native writer on Zoology in India or Ceylon.

Works by many authors have subsequently contributed much to our knowledge of the fauna of the island, both as a distinct unit and as part of the fauna of India generally. Among the former mention may be made of Sir W. Emerson Tennent's "Sketches of the Natural History of Ceylon" (1861), W. V. Legge's "Natural History of the Birds of Ceylon" (1880), F. Moore's "Lepidoptera of Ceylon" (1880–1887), Drs. Paul and Fritz Sarasin's "Ergebnisse naturwissenschaftlicher Forchungen auf Ceylon" (first part published in 1887), E. E. Green's

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"Coccidae of Ceylon" (first part published in 1896), K. Escherich's "Termitenleben auf Ceylon" (1911) and numerous papers by various authors in Herdman's "Report . . . . on the Pearl Oyster Fisheries of the Gulf of Manaar" (London, 1903–1906) and in "*Spolia Zeylanica.*" The serial *Spolia Zeylanica* began to be issued by the Colombo Museum in 1904, under the editorship of the Director, Dr A. Willey, who commenced the first number with an article on "The Constitution of the Fauna of Ceylon."

Turning now to the mainland of India J.G. Koenig's "Naturgeschichte der sogenannten Weissen Ameisen" (=so called White Ants) appeared in 1779; and James Anderson was already experimenting with indigenous "cochineal" insects when he was appointed Physician-General of Madras in 1786[1]; but it appears that Patrick Russell was the first to publish any extensive Zoological work. Russell was evidently a man of remarkable personality with an intense enthusiasm for scientific research. In 1750 he joined his elder brother Alexander at Aleppo, where the latter was physician to the English factory. To this post he succeeded on his brother's retirement in 1755. He made investigations on various subjects, which were transmitted to his brother for use in a revised edition of the latter's "Natural History of Aleppo," an edition which he himself completed after his brother's death; and he published, in the Philosophical Transactions of the Royal Society for 1760, an account of several remarkable earthquake shocks that occurred in Syria during the preceeding year. When plague broke out "After communicating to the English Consul instructions in writing for the observance of those attached to the English factory, he used to take leave of all his friends, who, at his express desire, shut themselves up within the limits of the factory, and did not suffer the least intercourse to be had with them. At the most imminent risk did Dr. Russell then apply himself to the treatment of the diseased. If he was not able to arrest the progress of that malady, he had thus at least the best opportunities of investigating its nature, watching its symptoms, and trying the effects of various powerful medicines and different modes of treatment" and thus acquired the requisite knowledge "for writing a history of that direful distemper" which was published in two volumes in 1791 under the title "Treatise on Plague."

After about twenty years at Aleppo he returned to England, investigating the principle lazarettos of Italy and France on his way.

For about nine years he practised medicine, first in Edinburgh and then in London. But in 1781 he gave up his practice in order to accompany to India his brother Claud, who

[1] Love's "Vestiges of Old Madras," III, p. p. 334.

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required constant medical attention. In India "he resided principally at Vizagapatam, his brother having been appointed to the highest office in that settlement. His time and attention were, in great measure, devoted to the natural history of that country, which had hitherto been little explored." In 1785 he became Naturalist to the East India Company in Madras on the death of the Botanist, J. G. Koenig, for whom the post had been created in 1778. But he left India for England in 1789, when he was succeeded by another botanist, Wm. Roxburgh. His "Account of Indian Serpents collected on the Coast of Coromandel" appeared in 1796, and was followed by the first fasciculus of a "Continuation" in 1801. In 1802 he published "Descriptions and Figures of Two Hundred Fishes collected at Vizagapatam on the Coast of Coromandel." Further fasciculi of his "Continuation of Indian Serpents" and other papers relating to these reptiles continued to appear till the time of his death after a brief illness in 1805, and some appeared posthumously.[1]

In 1793 Russell's successor, William Roxburgh, was transferred to Bengal to take charge of the Botanical Gardens at Calcutta, on the death of their founder Robert Kyd. He held this post till he retired in 1813, when he was succeeded in quick succession by William Carey and Francis Buchanan before a permanent Superintendent was found in Nathanial Wallich.

Francis Buchanan, to whom we must next turn our attention, was a native of Edinburgh and entered the East India Company's Bengal service as an Assistant Surgeon in 1794 at the age of 32. Soon after his arrival in Calcutta he accompanied Captain Symes on a mission to Ava and visited the Andaman Islands, devoting himself to the collection of natural history specimens. On his return he was stationed in various parts of the Sunderbans, where he studied the local fish and had some of them drawn with great accuracy. In 1800 he was sent to report upon Mysore and Malabar, then lately acquired from Tippu Sultan. His results, under the title "A journey from Madras through the Countries of Mysore, Canara and Malabar," appeared in three volumes between 1805 and 1807. In 1802 he accompanied Captain Knox to Nepal. After a brief sojourn at Barrackpur, where he had charge of the menagerie, he was directed in 1806 to make a statistical survey of Bengal and certain adjacent districts, work which occupied him to within a short time of his retirement to England in 1815. For family reasons he subsequently adopted the name of Hamilton—hence the double name Hamilton-Buchanan by which he is commonly known in Zoological

[1] Concerning Russell see "Memoir of the Life and Writings of Patrick Russell, M.D." on pp. ix–xv of his "Indian Serpents." Concerning Koenig see Russell's preface to Roxburgh's "Coromandel Plants."

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literature. After his retirement he first prepared and published work on Nepal and Assam and on the genealogies of Hindu Dynasties. His "Account of the Fishes found in the River Ganges and its Branches" appeared in 1822 and included drawings made up to 1806. His careful observations on fish and fisheries made in connection with the statistical survey were very imperfectly quoted by Montgomery Martin in 1838 in his "Eastern India" but were only published in full by Sir. William Hunter in 1877 in the twentieth volume of his "Statistical Account of Bengal"; and the drawings prepared during this period, of which one set are in the possession of the the Asiatic Society of Bengal,[1] are still unpublished. Hamilton-Buchanan died in 1829.[2]

In 1800, soon after Hamilton-Buchanan's arrival in India, E. Donovan began to publish the first "Natural History of the Insects of India." A revised edition of this work was subsequently issued in 1842 under the editorship of J. O. Westwood who, however, pointed out that many of the insects it contained belonged to the East Indies rather than to India proper, and that some even belonged to the West Indies. At about this time, also, Major General Thomas Hardwicke, himself the author of numerous papers on various branches of Indian Zoology (published 1798–1834), was making an extensive collection of natural history specimens with the aid of which John Edward Grey published his "Illustrations of Indian Zoology" between 1830 and 1832, including a large number of mammals, birds, reptiles and fish not only from India proper but also from China and Malaysia.

In 1829 Bryan Hodgson introduced Zoological studies into the Asiatic Society of Bengal, which up to that date had practically ignored them, partly perhaps because of the views of its founder, Sir Wm. Jones: "Could the figure, instincts and qualities" Jones said in an Anniversary Discourse, "be ascertained either on the plan of Buffon, or on that of Linnaeus without giving pain to the object of our examination, few studies would afford us more solid instruction, or more exquisite delight; but I never could learn by what right nor conceive with what feeling, a naturalist can occasion the misery of an innocent bird and leave its young, perhaps, to perish in a cold nest, because it has gay plumage, and has never been delineated, or deprive even a butterfly of its natural enjoyment, because it has the misfortune to be rare or beautiful."[3] Though our work can and should always be done in the humane spirit underlying these sentiments, the views

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[1] His MS. is also with this society.

[2] See Chaudhuri, *Journal Asiatic Society of Bengal* (N.S.) XIV, 1918, pp cxliii–cxlvi; also "Memoir of Dr. Francis Buchanan" in Vol. I of 2nd edition (1870) of his "Journey from Madras.....".

[3] Tenth Anniversary Discourse, *Asiatik Researches* iv.

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which led to their enunciation by the founder may well have exerted a strong influence against Zoological studies in the society. Bryan Hodgson, however, presented many valuable specimens to the Society's Museum , and contributed nearly a hundred papers to its *Researches* and *Journal* between 1829 and 1848. He was for many years Resident at the Court of Nepal, and made a special study of the bird and mammalian fauna of that country together with Sikkim and Tibet.[1] And it was his work that first made Calcutta the main centre of Zoological research in India.

In about 1839, John McClelland, a member of the Bengal Medical Service with a keen interest in Zoology, was appointed Curator of the Asiatic Society's Museum. He held this post for two years, after which he founded and edited the '*Calcutta Journal of Natural History*" from 1841 to 1847 when it ceased to be published. In 1841, he was succeeded as Curator by Edward Blyth, under whose care the collections increased until the Society's premises were crowded and the Society's funds no longer sufficed for their proper preservation and exhibition. Blyth held the post till shortly before the transference of the Museum to Government in 1864, when ill-health compelled him to retire to England. According to the Centenary Review of the Asiatic Society he was "the founder, in this country, of a school of what may be called field-zoologists. The active correspondence he kept on with the sportsmen-naturalists . . . . in various parts of the country, and his elaborate notices of the presentations which were made by them to the Society, not to speak of his numerous Memoirs, contributed an impetus to the study of Natural History that has done more to its extension in India than all the previous publications."

It is unnecessary for me to dwell at any further length upon Blyth's work or upon the work of John Anderson, the first Superintendent of the Imperial Indian Museum to which the Asiatic Society's collections were transferred as nucleus, nor need I say much concerning Anderson's no less distinguished contemporaries W. T. and H. F. Blanford, W. Theobald, H. Godwin-Austen, F. Stoliczka and G. and H. Nevill, whose work centred round these collections. Their names must be familiar to us all, and their chief work has already been recorded in the Centenary Volumes of the Asiatic Society of Bengal (1885) and Indian Museum (1914), together with those of their successors J. Wood-Masion, A. W. Alcock, I. de Niceville, the various Surgeon-Naturalists on the 'Investigator' and a number of others of less outstanding importance. I would, however, remind you that the chief zoogeographical subdivisions of India

[1] The Indian Museum : 1814–1914, p. 68, and Asiatic Society of Bengal "Centenary Review," p. 58.

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were briefly indicated in 1870[1] by W. T. Blanford[2] whose more detailed subsequent papers on the subject, published in 1876[3] and 1901,[4] respectively still provide the fullest statement of the subject that has appeared. And I must further point out the great impetus that the study of the invertebrate fauna of India received from members of this group.

Apart from Donovan's "Natural History of the Insects of India" already mentioned, Invertebrate Zoology remained almost untouched until 1830, when Benson and Hunter commenced their papers on land and freshwater shells in *Gleanings in Science* and the *Journal of the Asiatic Society*. Their work was continued by Theobald, the two Blanfords, Godwin-Austin, and Stoliczka; and extended to marine forms by the two Nevills.

In 1840, Rev. F. W. Hope published from England a paper "On the Entomology of the Himalayas and of India"[5] and in 1847, H. J. Carter of the Bombay Medical Service published in the *Transactions of the Bombay Medical and Physical Society* his "Notes on the species, structure and animality of the Freshwater Sponges in the Tanks of Bombay." "Carter commenced his investigations and carried out a great part of them, in Bombay with little of the apparatus now considered necessary and with a microscope that must have been grossly defective according to modern ideas. His long series of papers in the *Annals and Magazine of Natural History* is an enduring monument to Indian Zoology, and forms the best possible introduction to the Spongillidae. Even his earlier mistakes are instructive, for they are due not so much to actual errors in observation as to a faithful transcription of what was observed with faulty apparatus."[6] Carter in Bombay was thus the first to make a careful study of invertebrate animals as opposed to their dried remains.

The next to do this was Stoliczka[7] in Calcutta who about

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[1] "Notes on some Reptilia and Amphibia from Central India," *Journ. As. Soc. Bengal* XXXIX (II), 1870; zoogeographical subdivisions of India dealt with pp. 336–338.

[2] Concerning W. T. Blanford see obituary notice in *Rec. Geol. Survey of India*, XXXII, pp. 241–257.

[3] "The African Element in the Fauna of India: a Criticism of Mr. Wallace's views as expressed in the Geographical Distribution of Animals." *Ann. Mag. Nat. Hist.* (4) XVIII, 1876, pp. 277–294.

[4] The Distribution of Vertebrate Animals in India, Ceylon and Burma. *Phil. Trans. Roy. Soc.* (B) CXCIV, 1901, pp. 335–436, pl. XLIV.

[5] *Madras Journal of Literature and Science*, XII, 1840, pp. 105–129: Descriptions of Insects by J. O. Westwood, pp. 129–136.

[6] Annandale, *Fauna of British India*. Freshwater Sponges, Hydroids and Polyzoa, p. 55.

[7] Concerning Stoliczka see "Memoir of the Life and Work of Ferdinand Stoliczka" (1886, 36 pp.) in "Scientific Results of the Second Yarkand Mission (London, 1878–91).

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1869, commenced to publish his work on the anatomy, physiology and morphology and of various Invertebrate groups.[1] Stoliczka joined the Geological Survey of India in 1862, and died in 1874, on his way back from Central Asia, whither he had accompanied Sir Dougles Forsyth's Mission to Yarkand and Kashgar as Naturalist. But his wide general knowledge of different branches of zoology enabled him even in this short period to achieve a high standard of thoroughness, a standard which was ably maintained by two Superintendents of the Indian Museum, J. Wood-Mason and A. Alcock, his immediate successors in this field.

Having thus traced the foundation and early development of zoological work in India up to its permanent establishment in Calcutta, we must go back a few decades to consider certain more isolated naturalists who have made important contributions by the preparation of monographs dealing with different groups of the Vertebrata. The earliest of these is Thomas Caverhill Jerdon, who joined the Madras Medical Service in 1835, commenced his series of scientific papers with a carefully annotated "Catalogue of the Birds of the Peninsula of India" published in 1839 in the *Madras Journal of Literature and Science*, and was ultimately appointed by Government to prepare a series of manuals on the Indian Vertebrata. The way for these manuals had been prepared not only by his own work and that of some of the early pioneers above referred to; but also by the publication of several local catalogues, the earliest of these being Colonel W. H. Sykes' catalogues of the mammalia and birds of the Deccan, published in the *Proceedings of the Zoological Society of London* for 1831 and 1832 respectively and reprinted in the *Journal of the Asiatic Society of Bengal*; Major James Franklin's catalogue of birds collected on the Ganges between Calcutta and Benares and in the Vindhyian Hills, published in the same volume in 1831; Lieut. S. R. Tickell's list of birds collected in the jungles of Borabhum and Dholbhum, published in the *Journal of the Asiatic Society of Bengal* in 1833; and Sir Walter Elliott's catalogue of the mammals of the Southern Mahratta Country, published in the *Madras Journal of Literature and Science* in 1839.

Jerdon's first sixteen years in India were spent in various parts of the Madras Presidency, including Madras, Nellore, the Nilgiri Hills and Tellicherry on the Malabar Coast; and his papers in the *Madras Journal of Literature and Science* bear witness to the vigour of his researches into its zoology. Early in 1852 "he was appointed to the 4th Light Cavalry, then in the Saugor and Nerbudda territory, with which he served during the Mutiny of the Bengal army, where he saw some

[1] Asiatic Society of Bengal, Centenary Review, Pt. III, p. 67.

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active service. Peace having been restored, he went to Darjeeling on sick leave and made himself acquainted with many new forms peculiar to the Himalayan range. He then got himself appointed to a regiment in Burma (the 11th Native Infantry), and joining *via* Calcutta, lost no time in exploring this new field." In Calcutta he sought and obtained the patronage of Lord Canning for his projected series of manuals on Indian vertebrates; and shortly afterwards he was placed on special duty for this work. "He began with his favourite subject, Ornithology; the first volume of which, under the title 'The Birds of India' was published in Calcutta in 1862, followed by the second, in two parts, at intervals during 1863."

"Meantime the author, who had already 'traversed and re-traversed the length and breadth of the continent of India' with the exception of its North-Western portion, availed himself of the sanction given him to prosecute his researches in any quarter. During the next five or six years he visited the Punjab, Cashmere, and all the hill stations of the great northern range, and explored the valley of the Sutlej, penetrating as far as Chini. The volume of Mammalia did not appear until 1867. On the completion of this volume, he repaired to Darjeeling, where he occupied himself with the Manuals of Reptiles and Fish during the greater part of 1867-68. On the 28th February of the latter year he retired from the service; and having sent part of the manuscript of the Reptiles to the press, he visited Assam and the Khasi Hills. Whilst at Gowhatty, he was prostrated by a severe attack of fever from which he never entirely recovered. As soon as he was convalescent he hastened to Calcutta, and soon after returned to England, where he arrived in June 1870," and died in 1872. "He cared neither for fatigue nor privations in his wanderings; and being gifted with the power of rapid and accurate discrimination, he could detect at a glance peculiarities of form or habit indicative of a difference of species, even in birds on the wing."[1]

Jerdon's Manual of Reptiles was never published, so far as I have been able to ascertain, though Sir Walter Elliot states that it was printed and the sheets sent home after their author's death. And the Manual of Fishes was never finished. The former was, however, to some extent replaced even before its completion, by Gunther's "Reptiles of British India" prepared in London under the auspices of the Ray Society, by whom it was published in 1864, and the latter was ultimately replaced by Day's "Fishes of India," which began to appear in 1875 and was completed in 1878.

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[1] See Memoir of Dr. T. C. Jerdon, by Sir Walter Elliot; *Proceedings of the Berwickshire Naturalists' Club*, VI; reprinted in second edition of "The Birds of India."

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Francis Day joined the Madras Medical Service in 1852, and from 1859 to 1862, when he was on duty in Cochin, he states that he spent most of his spare time in collecting specimens of the fish along that coast, embodying the results in a volume entitled "Fishes of Malabar" which he published in 1865. In 1869 the Madras Government appointed him to investigate the possible injury to the coast fisheries resulting from the barring by irrigation works of seven of the principal rivers of the east coast, after which he was instructed to extend these enquiries into Orissa, Bengal, Burma and the Andamans

He paid a short visit to England in 1870, where he studied fish-ladders. On his return he was offered the post of Inspector-General of Fisheries, with power, when not required by Goverment in Calcutta, to travel about the country and collect information on subjects connected with the Department. His time was thus spent from January 1871 to early in 1874, during which period he visited every large river in India, and nearly the entire coast from Gwadur in Baluchistan to Mergui in Tenasserim.

His account of "The Fishes of India" as already noted appeared in parts between 1875 and 1878. This book dealt with a much larger area than did Jerdon's manuals, which latter included only Peninsular India and the country between it and the Indus in the east and the Himalayas in the north. Jerdon's manuals, however, afforded a great stimulus to work on the Indian Vertebrata, especially birds; and they were soon supplemented by G. E. Dobson's "Monograph of the Asiatic Chiroptera" in 1876, W. V. Legge's "History of the Birds of Ceylon" in 1880, and Eugene Oates' "Handbook of the birds of British Burmah" in 1883; while in 1888-90 James A. Murray, already the author of several works on the Zoology of Sind, published his "Avifauna of British India." Numerous papers, moreover, were contributed to the volumes of *Stray Feathers*, a periodical devoted to ornithology which was started in 1872 by Allan O. Hume and issued by him from Calcutta till 1888, when it came to an end. As complete compilations, therefore, the manuals were soon felt to be out of date, and on the recommendation of the Government of India the Secretary of State in Council sanctioned the commencement of the "Fauna of British India" series, under the editorship of W. T. Blanford in 1883. The first part of the first volume, on Mammals written by Blanford himself, appeared in 1888. The series now includes 39 volumes: but the subject is so vast that it seems almost as far as ever from being complete.

Apart from *Stray Feathers* and the earlier *Madras Journal of Literature and Science* (1833-73) and *Calcutta Journal of Natural History* (1841-1847) there was up to about this period only one journal in India in which zoological work could be

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published, namely, that of the *Asiatic Society of Bengal*[1]; and large monographic works had perforce to be published separately. Most of these were published either as the result of special Government action or independently. In 1860, however, Theobald published his "Catalogue of the Recent Shells in the Museum, Asiatic Society of Bengal" under the auspices of that Society—a work comparatively small in itself but the forerunner of a series of the highest importance. After the transference of the Society's Museum to Government such catalogues continued to appear, though under the auspices of the Trustees of Indian Museum. The first of these was Dobson's Monograph of the Asiatic Chiroptera (1876). It was commenced as a descriptive catalogue, this itself being a great advance on Theobald's list; but as it was found to include almost all the known Asiatic Chiroptera it was ultimately enlarged so as to include the whole of them, thus greatly enhancing its value at comparatively little cost. This volume was followed by Neville's Mollusc Catologue (one fasciculus only, 1877) and Handlists (1878–85) never, unfortunately, completed; and by Anderson and Sclater's Catalogue of the Mammalia (1881–1891). With Distant's Monograph of Oriental Cicadidae, published in parts between 1889 and 1892, the series entered upon a new phase in quarto, instead of octavo, form and illustrated by carefully executed plates. This was the first of a series of similar monographs, dealing for the most part with marine organisms, which continued to be published till the completion in 1914 of Koehler's work on the Echinoderms. By that time a regular serial in two sizes entitled "Records" and "Memoirs" respectively "of the Indian Museum," which had been started in 1907, was well established, rendering the further continuance of separate catalogues unnecessary. In 1916, the publication of these Records and Memoirs passed automatically, without change of title, from the Trustees of the Indian Museum to the newly established Zoological Survey of India; and the Investigator Illustrations, which were commenced in 1892 as a separate series composed of plates only, were incorporated with the "Memoirs."

In 1886, shortly before the Indian Museum Catalogues had reached their full development, the Bombay Natural History Society, founded in 1883, began to publish a journal destined to play a most useful part in Indian Zoological studies. Its object, as stated in the introduction to the first volume, was to "stimulate lovers of Nature, especially in all parts of this [*i.e.* the Bombay] Presidency, to record and communicate their observations. In accordance with the character which this Socie-

[1] With its predecessors the *Transactions of the Medical and Physical Society* and *Gleanings in Science*, concerning which see Centenary Review A.S.B., pp. 50–51.

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ty has assumed from the beginning, the aim of its journal will be, as far as possible, to interest all students of Nature, ever remembering that there are many Naturalists, in the highest sense of the term, who have not such a technical knowledge of any particular branch of the science as to be able enter with interest into questions of nomenclature and the discrimination of closely allied species. The Secretaries of the Sections would therefore invite sportsmen and others to communicate anything interesting or worthy of note, which comes under their observation, bearing on the nature and habits of animals or plants." True to these principles, this journal has for the past thirty-five years formed the recognised centre, not only in the Bombay Presidency but throughout the whole of India, for records of this description; and if of recent years some may feel that there has been an influx of dull and technical papers a glance at the volumes will show that instead of squeezing out popular matter, technical and popular matter have combined to swell their size far beyond their early modest dimensions. And as the technical papers deal mainly with the more popular groups, they form a most important supplement to the popular contributions.

In addition to the Indian zoological serials already mentioned J. A. Murray appears to have issued a magazine called the *Indian Annals and Magazine of Natural Science* from the Victoria Natural History Institute, Bombay[1] at about the time of the first appearance of the Journal of the Bombay Natural History Society; a few small papers relating to Zoology have been published from the Madras Museum both in its Bulletins and separately; and there are now serials issued by Government in connection with the Medical, Forest and Agricultural services, all of which accept Zoological papers bearing on their respective subjects.

This brief survey of the history of zoology in India is obviously incomplete. Thus not only does it make no attempt to describe the important work of zoologists still, happily, working in the country; but, in addition, the valuable marine work done by the "Investigator" has scarcely been mentioned, and no special attention has been paid to the zoological work of expeditions such as those of Leonardo Fea to Burma[2]; John Anderson to Yunnan (1868 and 1875)[3] and Mergui (1881–1882)[4] the Second Yarkand Mission, accompanied by F. Stoliczka (1873–4)[5] the

[1] See preface to his "Edible and Game Birds of British India" (London and Bombay, 1889).

[2] Results published in the *Ann. Mus. Civ. Genova* from 1869 onwards.

[3] See "Anatomical Zoological Researches; comprising an account of the zoological results of the two expeditions to Western Yunnan in 1868 and 1875; and a monograph of the two Cetacean genera, Platanista and Orcella" (London, 1878).

[4] *J. Linn. Soc. London* (Zool.) XXI–XXII, 1888–89.

[5] "Scientific Results of the Second Yarkand Mission" (London 1878–1891).

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Pamir Boundary Commission accompanied by A. W. Alcock (1896)[1] and J. Stanley Gardiner's expeditions to the Maldives and Laccadives in 1899–1900[2] and to the Indian Ocean under the Percy Sladen Trust Fund in 1905.[3] But I must not detain you further regarding them. It must suffice to point out that an account of the biological work of the Marine Survey of India forms the eigth chapter of the Indian Museum Centenary Volume already referred to; and that an account of a number of expeditions will be found in the seventh chapter of the same volume.

So much for the past. What of the present and the future?

We are met this year in a city which, if it cannot claim to have been the home of the first Indian Zoologist, has yet an unbroken record of Zoological work going back for nearly a century—or indeed for over a century if we can disregard the short gap between Bryan Hodgson and Hamilton-Buchanan—a record which I venture to think could not be parallelled by many cities other than those Western ones, among whose ancient Universities modern science first arose. We see around us well stocked libraries and other facilities for research, and may even feel something of that "scientific atmosphere" for which more than one Zoologist in this country has been known to pine. No wonder Zoology flourishes here! What could not each of us do with like equipments!

To whom, then, is the provision of this equipment due? To individuals, not unlike ourselves, or to Government? Undoubtedly it is in some measure due to both; but primarily I think to individuals filled with a keen desire to learn all they could about the country in which they were living and to investigate the unknown, not merely to gratify their personal curiosity, but in order to add, for the benefit of all, to the sum total of human knowledge. Except in the limited field known as Applied Science, where a money standard can to some extent be used, it is impossible to determine the value of such investigations. Gradually their results become absorbed into our general culture, bringing it more nearly into accord with the fundamental laws of nature, which are the laws of right living and of health. This is sufficiently recognised for assistance to be given in aid of the pursuit of knowledge for its own sake by the Governments of all civilised countries. But the *initiative* must lie not with an impersonal Government, but with individual persons.

Thus Knox and Russel, the earliest Zoologists in Ceylon

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1 "Report on the Natural History Results of the Pamir Boundary Commission" (Calcutta, 1898).

2 "The Fauna and Geography of the Maldive and Laccadive Archipelagoes" (Cambridge, 1901–1906).

3 "The Percy Sladen Trust Expedition to the Indian Ocean in 1905 under the leadership of Mr. J. Stanley Gardiner, M.A.," Trans. Linn. London (2 zool.) XII–XVII, 1907 onwards.

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and India respectively, first made their investigations and then obtained assistance from the East India Company in publishing them. Hamilton-Buchanan began by making collections and observations wherever he happened to be stationed and thus acquired the experience which enabled Government to detail him for special work which facilitated their extension. His "Fishes of the Ganges" appears to have been published on his own account. Of his later work done for Government none worth the name was published till long after his death, while the plates have still to be consulted in original. Jerdon and Day also commenced their observations independently, afterwards obtaining Government help; Day's first book was published on his own account and Jerdon's earlier papers in a Journal issued by a private society, namely the Madras Literary Society.

Thus was it also with the founders of the Calcutta centre of Zoological research, none of whom, with the possible exception of Edward Blyth, were professional Zoologists at all, in the sense of being dependent on Zoology for their livelihood. Their Zoological work, as we have already seen, centred round the Asiatic Society of Bengal, a private society which was supported by thier own work and subscriptions, and by those of their fellow members. Yet it is to their efforts, and to those of their successors, that the provision by Government of the facilities for research that we see here is ultimateley due.

What has been done once can be done again; and the recent work of Col. Stephenson in Lahore, both as an investigator and as a teacher, is in itself an illustration of what a comparatively isolated worker can do if he will under more modern conditions.

That isolation, especially from libraries, must involve serious difficulties to any investigator is, however, obvious; and in a country of the large size and low average education and wealth of India, some degree of isolation is bound to be the lot of many, probably for a number of years to come. What, then, can we do to minimise these difficulties?

Different circumstances produce different opportunities, and as our circumstances are in large measure beyond our individual control, so also must it be with our opportunities. In India, therefore, where our circumstances are so markedly diverse and so often changed, it especially behoves us to keep our outlook wide enough to embrace any opportunity for research that may present itself, even though it may not permit of the precise type of work towards which we incline.

And above all let us be thorough. To make a complete survey of all work, whether biological, morphological or taxonomic, done since the last such survey, in whatever field we may enter, is rarely easy and will sometimes prove impossible; to neglect an opportunity because we cannot do this will some-

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times be undesirable. But the former should always be our aim; and the latter will perhaps not infrequently be one way of attaining it. More than half our difficulties, especially in the case of isolated workers, are I believe due to the absence of any ready means of acquainting ourselves with what has been already done. The "Fauna of British India" series was originally intended to meet this need in so far as the determination of species is concerned: but its earlier volumes have long been out of date and require either to be supplemented or rewritten; and the later ones have mostly been prepared by men who, never having worked in India, cannot be expected properly to appreciate our needs. It thus remains for us to supply the need ourselves as best we can.

If our work is to be really thorough we must especially guard against the false distinction that is now too commonly drawn between morphological and taxonomic zoology. No one can hope to be a really good morphologist unless he is also a sound taxonomist; for otherwise he is likely to misunderstand anatomical distinctions—as has already happened in the case of certain Indian earthworms. No one can hope to be a really good taxonomist unless he is also a sound morphologist; for otherwise he is likely to confuse under one name organs of similar position and appearance but different origin, with results disastrous to classification and most perplexing to those who have to interpret his descriptions without reference to specimens which he has named. And both morphologist and taxonomist —especially the latter—should be experienced field naturalists. I believe, indeed, that it is largely due to the amount of taxonomic work that has been done without due regard to morphology and biology that has brought taxonomy into its present disrepute in England. Morphology and sytematics are interdependent and cannot properly be separated either from each other or from the study of living specimens in their natural environment; though it is only natural that one or other should predominate in different pieces of work. In Europe, with its comparatively limited and well-explored fauna, morphology commonly offers much greater scope for investigation than does taxonomy. In India, with its much richer and largely unexplored fauna, this is not so, and thus it happens that all the greater Indian Zoologists have hitherto been taxonomists. But their taxonomic work has been based on careful investigations into anatomy and field biology, thereby establishing for us a fine tradition. May we worthily maintain it in all parts of the country.

Observations on the luminosity of some estuarine animals in the Gangetic delta.—*By* B. PRASHAD.

After discussing the various methods of the production of light by aquatic animals the author describes the observations made by him on

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the luminosity of some of the estuarine animals in the Gangetic delta. Some doubtful records of the occurrence of this phenomena are rejected in view of the present investigations, and all authentic cases observed by him are discussed at some length.

Notes on the occasional absence of the paired fins in fresh-water fishes.—*By* Sundar Lal Hora.

The author refers to four abnormal specimens, three of which were recently collected in Manipur. The abnormality consists in one case in the total absence of the ventral fins; in two other cases the ventral fin is absent only on one side: while in the fourth specimen one of the pectoral fins is absent. Such abnormalities have been considered to be instances of genital variations or mutations in fishes. The author regards them as cases of injury to the developing embryo. The validity of the two apodal genera *Channa* and *Apua* is discussed in the light of these observations.

The fauna of the Loktak Lake in Manipur.—*By* N. Annandale *and* S. L. Hora.

The Loktak lake is a body of water occupying a shallow depression in the Manipur valley. It is almost choked with submerged vegetation and a large part of its area is covered with floating islands composed largely of grasses and sedges. Its outflow finally drains into the Chindwin river, the largest tributary of the Irrawady. In many respects physical conditions are the same as those in the Inlé lake in the Southern Shan States, but certain factors are different, notably the chemical composition of the water.

The fauna of the two lakes is totally different in facies and composition. That of the Loktak lake is entirely paludine. Certain species are very abundant, but the number of species is comparatively small and very few of these are highly specialized. The two most important groups are the fishes and the molluscs, for the lower invertebrates are poorly represented. In neither group do we find any real endemic element. Perhaps the most characteristic forms are two gigantic Viviparid Gastropods, *Vivipara oxytropis* and *Lecythoconcha lecythis*. These are remarkable for their very large but thin shells, which lack the extravagant sculpture of the Viviparidae of the Inlé lake. Neither species is confined to the Manipur valley.

The external ornamentation of the shell in the Viviparidae.—*By* N. Annandale.

The ornamentation of the shell in the pond-snails (Viviparidae) is partly periostracal ("epidermal"), partly impressed on the outer calcareous layers. In the young shell at birth the most important feature of the sculpture is the presence in a very definite position of fine horny chaetae arranged in three or more spiral rows. These chaetae are entirely periostracal. They disappear to a large extent in the adult, but traces of them can usually be found. The fully developed shell differs considerably in sculpture in different genera and species, but the ornamentation has the same arrangement as in the embryonic shell, that is to say, is disposed along the same spiral lines. The sculpture, however, mainly affects the true test or calcareous part of the shell.

The outer layers of the shell are secreted by two sets of glands situated at the edge of the mantle, namely, the periostracal glands and the calciferous glands. Their functions are indicated in the names given them. Corresponding in position with the sculpture we find a series of processes, usually minute but sometimes hypertrophied, on the extreme edge of the margin. These act as moulding organs in the periostracal

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sculpture of the embryonic shell and in the adult of certain species in which they are hyportrophied (e.g. *Vivipara oxytropis*) are directly associated with the presence of smooth and prominent but hollow spiral ridges on its external surface. The more elaborate and more broken sculpture of such forms as *Taia naticoides* and *Margarya melanoides* is, however, not due to the action of these processes, although it corresponds in position with them, but is correlated with temporary and partial hypertropy of the calciferous glands.

Notes on the venous system of *Varanus bengalensis*.—*By* D. R. Bhattacharya.

The main points calling forth attention in the venous system of *Varanus bengalensis* are the following:—

(1) In addition to the medianly situated anterior abdominal vein formed by the confluence of two pelvic veins, a well-developed and paired system of epigastric veins is present, each of the two epigastric viens opening separately into the anterior end of the liver of its side.

(2) A pair of blood vessels which anteriorly become joined together to form the main trunk of the hepatic portal system, arise each from the renal portal vein of its side, thus establishing a direct communication between the renal portal system and hepatic portal system.

(3) The postcaval vein splits into two posteriorly and each branch instead of ending in the substance of the kidney, sends branches into it and reappears at the posterior end of the kidney and forms a complete loop by junction with its fellow of the opposite side.

(4) The umbilical vein or any vestige of it is not to be seen, at any rate in the adult.

Preliminary observation on the eyes of the amphipod, *Quadrivisio bengalensis*, Stebbing.—*By* B. Chopra.

The amphipod *Quadrivisio bengalensis*, a common species on the east coast of India, is remarkable for possessing two pairs of compound eyes on each side. In the young each of these pairs is represented by a single eye, which later separates into two, the two halves remaining joined together for a period. In Indian specimens the minute structure of the eye is normal, except for the presence of a number of apparently chitinous bodies connected with the crystalline cone. Cheurent has, however, recorded specimens (from underground waters in Zanzibar) in which the eyes are markedly degenerate.

Morphology and biology of the red cotton bug, *Dysdercus cingulatus* (Fabr.).—*By* Hem Singh Pruthi.

Habits, life-history, external and internal anatomy are described in detail.

The pigment giving a general red colour to the insect penetrates some of the internal organs also, e.g. testes, stink glands, etc. It cannot be extracted by any grade of alcohol.

Both pairs of wings though well developed are seldom used. The movement from plant to plant is affected by walking rather than flight.

The copulation may last as long as 72 hours and in this process the heads of male and female are turned towards the opposite sides. The normal activities—food taking and locomotion—are carried on as usual.

There are very slight changes in the external anatomy during development.

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Like a few other *Heteroptera*, it has well developed fulera, situated on the sides of the clypeus.

The mesonotum is differentiated into the four typical sclerites—the Prescutum, Scutum, Scutellum and Postscutellum—but the case of Metanotum is unlike that of the majority of *Heteroptera*. It has only two pieces, which is a primitive feature.

The pleural sutures present in *Heteroptera* in general are quite absent here. In the hind wings there is an extra vein between the costal apicalis and costal decurrens—this is not described by Feiber who names these veins.

The variation in the number of cells of the fore wing is an interesting feature, it may differ in the two wings of the same individual.

The gonopophyses of the female are much reduced, probably correlated with the fact that the eggs are laid in loose soil near the base of the plant and female has not to pierce hard woody tissues for the purpose.

The statement that there are only nine spiracles in *Hemiptera* does not hold good for this insect. In the female a tenth spiracle, though in the process of degeneration, is present on the 8th abdominal segment

The pharynx has a characteristic structure adapted to the sucking habit of the bug. It is continuous with the suction canal, formed by the two maxillae. A pedent epipharynx is absent.

There is a pair of salivary glands—salivary receptacles as separate organs, are not present. But the arrangement of different parts and salivary ducts shows that they are confluent with glands themselves.

No part of the alimentary canal intervenes between the malpighian tubules and the beginning of the rectum.

Testes are not follicular, but compact, two in number. They lie ventral to the alimentary canal and not dorsal to it, as is the case in insects generally. Male accessory glands, two in number, assume a huge size during the reproductive activity of the insect.

Ovaries—one pair—each consist of seven tubules and not eight (as in other bugs); further all the tubules lie in one plane—both are uncommon features. Besides the usual accessory glands and spermatheca, there is a peculiar funnel-shaped gland with its duct opening into the lumen of the uterus.

There is an extreme degree of concentration, only two ganglia on the ventral nerve card.

A pair of red bag-like stink glands, connected to each other by a transverse duct, lie on the ventral wall of the metathorax, below the ventral nerve cord and behind the second thoracic ganglia.

The tracheae of the respiratory system were studied after injecting them with Indian ink. Curiously the ventral branches of the main tracheae of one side were not joining with each other to form the continuous ventral longitudinal trunk. This arrangement is not found in any insect described in the literature available. The usual dorsal longitudinal trunks are present.

Certain points in the vascular system of *Varanus bengalensis*.—*By* G. S. Thapar.

Our present knowledge of the vascular system of the genus *Varanus* is chiefly due to Hochstetter and Beddard, but their descriptions do not apply to the case under consideration. The noteworthy points in the present case are:—

1. The presence of external jugular veins on both sides in connection with the anterior venae cavae. These form, as in birds, the jugular plexus.
2. Azygos vein from the right superior vena cava is quite independent vein terminating in the body wall. It has no connection

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with the suprarenal portal system, as described by Beddard.

3. Peculiarities in the portal system. Besides other branches joining the liver, we find both the branches of the femoral vein, unlike amphibia, take part in the formation of the hepatic portal system. Pelvic veins of both sides unite to form anterior abdominal vein, while the other branch of the femoral, unlike amphibia, and other lizards, runs along the rectum and after receiving a branch from the hypogastric forms one of the roots of the hepatic portal vein.
4. Suprarenal body lying anterior to the kidneys has its own blood supply and forms what is known as suprarenal portal system. Beddard's statement regarding its formation in *V. griseus* is confirmed for this species as well. Renal portal system is considerably reduced, being represented only by the hypogastric veins formed by the division of the caudal vein from the tail.
5. A more complete account of the arterial system is given than had previously been furnished. The chief points calling for attention are :—

(*a*) The common origin of the epigastric arteries from the innominate (common carotid) and the origin of a branch to the liver from the left epigastric only.

(*b*) The presence of only the dorsal type of the subclavian artery, arising as a single vessel from the right systemic.

(*c*) The origin of two visceral arteries from the left systemic before its union with the right.

(*d*) The supply of blood to the stomach by two distinct arteries —one arising independently from the left systemic and the other as usual a branch from the mesenteric artery.

General habits and some systems from the anatomy of Lahore *Scolopendra*.—*By* M. L. Bhatia.

Scolopendra is not abundant in Lahore and it is not therefore easy to obtain the specimens. In summer and spring their number is comparatively larger. Division of the body into segments and large number of legs help in rapid locomotion, consequently the legs of the animal are powerful and divided into distinct joints.

From shape and structure of the head appendages *Scolopendra* appears to be a powerful carnivorous animal able to wage war with large insect tribes. The animal has got a number of slit-like respiratory openings which are nearly laterally situated on alternate segments in pleura. Their number and position is constant in all the animals.

Internally the alimentary canal is a straight tube, and can be conveniently divided into oesophagus, crop, midgut, etc. A pair of convoluted malpighian tubules lie on the sides of the alimentary canal and enter in to it between the segments 19, 20. Two pairs of salivary glands are situated laterally to the oesophagus each having a definite duct of its own.

The nervous system consists of a ring-like structure in the anterior region forming an oesophageal collar round the oesophagus. Supra-oesophageal mass or the brain proper is represented by two pear-shaped quadrilobate masses, touching each other at their bases. The suboesophageal ganglion is a thick compound structure from which nerves for four pairs of head appendages or jaws arise.

From the suboesophageal ganglion runs the double ventral nerve cord, uniting with each other in the centre of each leg-bearing segment to form ganglia. Every segment has its own nerve supply from the ganglionic swellings.

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An instance of convergent evolution in Coleoptera.—*By* S. MAULIK.

The present paper aims at describing two remarkable beetles, one from the Garo Hills, Assam, and the other from Barkuda Island, Chilka Lake. In structure they differ considerably, but they bear a close resemblance in the extraordinary development of the terminal joints of *both* maxillary and labial palpi. This may be regarded as an interesting instance of convergent evolution. One of the beetles belongs to the family Malacodermidae and the position of the other is doubtful.

On the systematic position of a new genus *Rewaridrilus* from Benares.—*By* H. R. MEHRA.

1. *The distinguishing characters.*—The dorsal setae begin in the second segment, are capilliform and uncinate; the ventral setae uncinate only: the penial setae are the ventral setae of the 7th segment. The clitellum occupies segments 7 and 8. The male genital aperture is a large median quadrangular depression on the ventral surface of the 7th segment. The two vasa deferentia open separately in the male aperture; they are long tubes, the terminal portion of each of which is convoluted and enclosed by a covering of muscle fibres to form a structure not unlike the coelomic sac of some Tubificids (*Kawamuria* and *Branchiura*). The atrium is the swollen portion following the seminal funnel, which opens in the 6th segment, and is surrounded by the prostate. The sperm sac formed by the backward extension of the septum $\frac{6}{7}$ and ovisac by that of the septum $\frac{7}{8}$ resemble those in the Naididae. Testes and ovaries lie on the septa $\frac{5}{6}$ and $\frac{9}{7}$ respectively and the spermathecae in segment 6.

2. The question of the systematic position is beset with some difficulties. With respect to the position of the genital organs and the nature of the sperm- and ovi-sacs the worms come near the family Naididae, but in the structure of the male deferent apparatus, prostate and coelomic sac they approach the Tubificidae. The latter structure is different from that in *Kawamuria* and *Branchiura* owing to the atrium not being enclosed in it. There is no para-atrium also. In possessing one median male opening they resemble the *Bothrioneuron*.

On a hitherto unrecorded vein and an artery in the circulatory system of the common Indian frog, *Rana tigrina*.—*By* H. C. AHUJA.

1. The so-called oesophageal artery of the frog has not been observed arising directly from the systematic arch. On the other hand, there is a distinct branch of the "Occipito-Vertebral Artery" going to the oesophagus.

2. A fairly conspicuous vein joins the renal portal vein a little above the point where the femoral vein bifurcates into the pelvic and the renal portal. It is proposed to give a separate name to this.

3. A buff-coloured glandular body of a large size, somewhat conical in shape, lying immediately anterior to the heart, has also been observed.

Parthenogenesis in the Braconidae (Hymenoptera).—*By* M. A. HUSAIN.

Parthenogenesis is known to occur in a number of insects belonging to the order Hymenoptera; but there seems to be no record of the occurrence of this phenomenon in the family Braconidae. While breeding *Microbracon sp.*, a parasite of *Earias fabia* and *E. insulana*, it was found that all the eggs laid by certain females developed into males only.

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Further observations proved conclusively that all unfertilised females laid eggs that developed only into males.

In addition to the scientific interest this phenomenon is of great importance in applied entomology.

Section of Botany.

President:- PROFESSOR B. SAHNI, M.A., D.Sc.

Presidential Address.

THE PRESENT POSITION OF INDIAN PALAEOBOTANY.

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INTRODUCTION.

It has probably occurred to other botanists here present, as it has to myself, that the study of extinct forms of plant life has hitherto occupied, in Indian Botany, only a very subordinate position. From the geological side, of course, the

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TABLE I.

Vertical Range of the more important Genera of Indian Gl[illegible]ants

		Carboniferous.		Permian.			Triassorhaetic.			Jurassic.			Lower Cretaceous.		
		Talchir.	Karharbari.	Barakar.	Ironstone Shales.	Raniganj.	Panchet.	Maleri.	Parsora.	Rajmahal.	Kota.	Jabalpur.	Umia.		
Cordaitales	*Cordaites*														
	Euryphyllum														
Seeds	*Samaropsis*														
	Cordaicarpus														
Equisetales	*Schizoneura*														
	Phyllotheca														
	Equisetites														
Lycopodiales	*Lycopodites*														
	Bothrodendron														
Sphen.	*Sphenophyllum*														
?	*Ottokaria*														
	Arberia														
	Squamae														
Fronds of uncertain position.	*Glossopteris*														
	Vertebraria														
	Gangamopteris														
	Neuropteridium														
	Psygmophyllum														
	Rhipidopsis														
	Barakaria														
	Callipteridium														
	Sphenopteris														
	Alethopt. Medlicottiana														
	Pecopteris.														
	Cyclopt. pachyrhachis														
	Belemnopteris														
	Merianopteris														
	Dictyopteridium														
	Palaeovittaria														
	Morania														
	Buriadia														
														Elatocladus.	[illegible]re.
														Araucarites (Cone-Scale).	
														? Voltzia.	
														Ptilophyllum.	Cycadophyta.
														Williamsonia.	
														Bucklandia.	
														Otozamites.	
														Dictyozamites.	
														Tæniopteris.	
														Pseudoctenis.	
														Nilssonia.	
														Ginkgoites.	Ginkgoales.
														Coniopteris.	Filicales
														Gleichenites.	
														Cladophlebis.	
														Marattiopsis.	
														Danæopsis (? Thinnfeldia) Hughesi.	
														Thinnfeldia.	
														Eboracia.	
		Lower Gondwana.								Upper Gondwana.					

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TABLE II.

Indian Fossil Floras.

			WOODS.	LEAVES.	FRUITS AND SEEDS.	FOSSIL RESINS.
		Pleistocene and Recent.	Submerged Forests on Bombay Island (*Acacia Catechu*) and on Tinnevelli Coast.			
		Pliocene.	Siwalik System (Silicified Monocotyledonous and Dicotyledonous woods).	Upper Karewas of Kashmir (*Quercus, Alnus, Buxus, Cinnamomum*). Siwalik System (Leaves).		
		Miocene.	Sandstones			
		Oligocene.	Middle Tertiary Flora of Bombay (Wood).	Murree and Kasauli Series of W. Himalaya (*Sabal major* Heer, and other Angiosperms). Middle Tertiary Flora of Assam (*Phyllites Acacia*, Dicotyledonous Leaves, etc.)		Middle Tertiary Flora of Upper Burma and Travancore.
		Eocene.	Cuddalore (Silicified Tree-trunks); *Peuce Schmidtiana*. Upper Nari Series of Bugti and Marri Country (Silicified Tree-trunks).	Laki Series of Salt Range, Baluchistan, Sind, Jammu, etc. (Leaf-impressions of Angiosperms). Ranikot Series (Sind), (Dicotyledonous Leaves).	Laki Series of Salt Range, etc. (Fruits and Seeds of Angiosperms). Pab Sandstones of Fort Munro (U. Cretaceous or L. Eocene) (Triocniar Fruit.)	

Cretaceous			Rajputana. Balmir Sandstones (Net-veined leaves and dicotyledonous wood).	Deccan Trap Area. Inter-Trappean Beds. (*Chara Malcolmsonii* Sow., Angiosperm leaves and wood). Lameta Beds (Infra-Trappean Beds) (Angiosperms).	South India. Ariyalur Stage, Trichinopoly Stage, Utatur Stage (Silicified wood; *Protocyathea trichinopolicensis* Fstm.: Fruit-like body).	
		Umia.	Filicales. *Cladophlebis denticulata Brongn.* Incertae. **Actinopteris* sp. **Pachypteris* sp.	Coniferales. *Brachyphyllum expansum* (Sternb.). *Araucarites cutchensis* Fstm. ,, *macropterus* Fstm. *Elatocladus plana* (Fstm.) *Retinosporites indica* (O. & M.)	Cycadophyta. *Ptilophyllum acutifolium* Morr. **Williamsonia Blanfordi* Fstm. **Taeniopteris vittata Brongn.*	
		Jabalpur.	Filicales. **Gleichenites rewahensis* Fstm. *Cladophlebis denticulata Brongn.* **Eboracia lobifolia (Phill.)* Incertae. **Phoenicopsis* sp. ? **Alethopteris Medlicottiana Oldh.*	Coniferales. **Pagiophyllum* sp. cf. *P. peregrinum Schimp.* *Brachyphyllum expansum* (Sternb.). *Elatocladus plana* (Fstm.). *Araucarites cutchensis* Fstm. ,, *macropterus* Fstm. ,, *latifolius* Fstm. *Retinosporites indica* (O. & M.).	Cycadophyta. *Ptilophyllum acutifolium Morr.* *Williamsonia indica Sew.* Ginkgoales. **Ginkgoites lobata Fstm.*	
		Kota.	Filicales. *Cladophlebis denticulata Brongn.* **Thinnfeldia subtrigona Fstm.*	Coniferales. *Retinosporites indica* (O. & M.). *Elatocladus plana* (Fstm.). ,, *conferta* (Morr.). *Brachyphyllum expansum* (Sternb.). *Araucarites cutchensis* Fstm. ,, *macropterus* Fstm. **Torreyites constricta* (Fstm.).	Cycadophyta. *Ptilophyllum acutifolium Morr.* *Otozamites bengalensis* (Morr.). ** ,, bunburyanus var. indica Sew. & Sah.* *Taeniopteris McClellandi* (Morr.). ,, *spathulata* (Morr.). *Dictyozamites falcatus* (Morr.). **Pseudoctenis Footeana* (Fstm.). Ginkgoales. **Ginkgoites crassipes* (Fstm.).	Upper Gondwana.
Jurassic.		Rajmahal.	Filicales. **Marattiopsis macrocarpa* (Morr.). **Thinnfeldia indica Fstm.* **Gleichenites gleichenoides* (Morr.). *Cladophlebis denticulata Brongn.* **Coniopteris hymenophylloides Brongn.* Lycopodiales. **Lycopodites gracilis* (Morr.). Equisetales. **Equisetites rajmahalensis* (Schimp.) Incertae. **Sphenopteris Hislopi* (O. & M.). *Pecopteris lobata O. & M.* *Danaeopsis rajmahalensis Fstm.* Fructifications (cone-like).	*Ptilophyllum acutifolium Morris.* **Williamsonia microps* Fstm. ,, *indica Sew.* ,, sp. cf. *W. setosa Nath.* ,, sp. **Bucklandia indica Sew.* *Otozamites bengalensis* (Morr.). *Dictyozamites falcatus* (Morr.). **Taeniopteris lata Oldh.* ** ,, Morrisii Oldh.* ** ,, musaefolia Oldh.* ** ,, ovata* (Schimp.). ** ,, crassinervis* (Fstm.). ,, *spathulata* (McCl.). ,, cf. *T. McClellandi* (Morr.).	**Nilssonia princeps* (O. & M.). ** ,, rajmahalensis* (Oldh.). ** ,, Morrisiana* (Oldh.). ** ,, Medlicottiana* (O. & M.). ** ,, bindrabunensis Sew. & Sah.* ** ,, fissa* (Fstm.).	
				Cycadophyta. Coniferales. *Elatocladus conferta* (Morr.). *Retinosporites indica* (O. & M.).		
Triasso-rhaetic.		Parsora.	Incertae. *Glossopteris indica Schimp.* *Vertebraria indica Royle.* *Samaropsis* sp. *Squamae.*	Filicales. **Danaeopsis* (?*Thinnfeldia*) *Hughesi* Fstm. *Thinnfeldia odontopteroides* (Morris.). *Cladophlebis denticulata Brongn.*	Cordaitales. *Cordaites Hislopi* (Bunb.). Equisetales. *Schizoneura gondwanensis Fstm.*	
		Maleri.	No Plant Remains.			
		Panchet.	Incertae. *Glossopteris angustifolia Brongn.* ,, *indica Schimp.* *Vertebraria indica Royle.* **Cyclopteris pachyrhachis Goepp.* **Pecopteris concinna Presl.* *Samaropsis* sp.	Filicales. *Thinnfeldia odontopteroides* (Morr.).	Cycadophyta. *Taentopteris* sp. Equisetales. *Schizoneura gondwanensis Fstm.*	
Permian.		Raniganj.	Incertae. *Glossopteris Browniana Brongn.* ,, *retifera Fstm.* ,, *angustifolia Brongn.* ,, *stricta Bunb.* ** ,, tortuosa Zeill.* ** ,, formosa Fstm.* ** ,, divergens Fstm.* ** ,, conspicua Fstm.* ,, *indica Schimp.* *Vertebraria indica Royle.* **Gangamopteris Whittiana Fstm.* **Rhipidopsis densinervis Fstm.* **Palaeovittaria Kurzi Fstm.* **Belemnopteris Wood-Masoniana Fstm.* **Merianopteris major Fstm.* **Sphenopteris Hughesi* (Fstm.). ,, *polymorpha* (Fstm.). **Pecopteris phegopteroides* (Fstm). *Dictyopteridium sporiferum Fstm.* *?Voltzia heterophylla* (cone-scale). *Samaropsis raniganjensis Sew. & Sah.* *Squama forma lacerata* (Fstm.). ,, ,, *integerrima Sew. & Sah.*	Equisetales. **Phyllotheca robusta Fstm.* (? Raniganj age) ** ,, indica Bunb.* *Schizoneura gondwanensis Fstm.* **Actinopteris bengalensis Fstm.* Filicales. **Cladophlebis Roylei Arber.*	Cordaitales. *Cordaites Hislopi (Bunb.)* Cycadophyta. *Taeniopteris danaeoides* (Royle). ,, *Feddeni* (Fstm.). ,, sp. cf. *T. McClellandi* (Morr.). Sphenophyllales. *Sphenophyllum speciosum* (Royle.)	Lower Gondwana.
		Iron-stone Shales.	Incertae. *Glossopteris indica Schimp.* *Gangamopteris cyclopteroides Fstm.* ,, *ampla Dana.* Insect-wing-like Leaf.	Lycopodiales. **Bothrodendron* sp.	Cordaitales. *Cordaites Hislopi* (Bunb.).	
		Barakar.	Incertae. *Glossopteris ampla Dana.* ,, *retifera Fstm.* ,, *indica Schimp.* *Vertebraria indica Royle.* *Gangamopteris cyclopteroides Fstm.* *Sphenopteris polymorpha Fstm.* **Barakaria dichotoma* (Fstm.). **Rhipidopsis ginkgoides Schmal.* *Dictyopteridium sporiferum Fstm.* *Squamae.* *Cordaicarpus* sp. cf. *C. Cordai* (Gein). Seeds (other than *Cordaicarpus*).	Equisetales. *Schizoneura gondwanensis Fstm.* **Phyllotheca Griesbachi Zeill.* Cycadophyta. **Pseudoctenis Falli* (Fstm.). *Taeniopteris danaeoides* (Royle). ,, *Feddeni* (Fstm.).	Cordaitales. *Cordaites Hislopi* (Bunb.) **Dadoxylon indicum Hold.* ** ,, bengalense Hold.* Sphenophyllales. *Sphenophyllum speciosum* (Royle.).	
Carboniferous.		Karharbari.	Incertae. *Glossopteris indica Schimp.* ** ,, decipiens Fstm.* ** ,, longicaulis Fstm.* *Vertebraria indica Royle.* *Gangamopteris cyclopteroides Fstm.* ,, ,, *var. major Fstm.* ,, *angustifolia McCoy.* ** ,, ? buriatica Fstm.* **Neuropteridium validum Fstm.* **Callipteridium* sp. (?) **Ottokaria bengalensis Zeill.* **Morania Oldhami* (Zeill). **Buriadia heterophylla* (Fstm.) **Arberia indica White.*	*Samaropsis raniganjensis Sew. and Sah.* ,, *Milleri* (Fstm.). **Cordaicarpus indicus* (Zeill.). Seeds (other than those above). *Squama forma lacerata* (Fstm.). ,, ,, *integerrima Sew. and Sah.*	Cordaitales. *Cordaites Hislopi* (Bunb.) ** ,, Stoliczkanus* (Fstm.). **Euryphyllum Whittianum Fstm.* Equisetales. *Schizoneura gondwanensis Fstm.* ** ,, Wardi Zeill.*	
		Talchir.	Incertae. *Pecopteris* sp. ** Psygmophyllum Hollandi Sew.* ** ,, Haydeni Sew.* ** Gangamopteris Kashmirensis Sew.* *Samaropsis* sp. *Gangamopteris cyclopteroides Fstm.* *Glossopteris indica Schimp.* *Vertebraria* sp.	Cordaitales. *Cordaites Hislopi* (Bunb.).	Equisetales. *Schizoneura gondwanensis Fstm.*	
	Po Series		cf. *Rhacopteris inaequilatera Fstm.* (non Goepp.); cf. *Sphenopteridium dichotomum Stur*; *cillatum Ludwig* sp.; cf. *Sphenopteris rigida Ludwig.*			
Lower Silurian.			Unnamed Plants from Spiti.			
Vindhyan.			"*Fucoids*"—probably tracks of animals.			
Cuddapah.			? "*Cryptozoon.*"			

*These species are known in India with certainty only from the strata mentioned against them.

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इस पुस्तक वितरित न की जाय
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fossil plants of India have received a great deal of attention. Indeed, it is to the geologists that we owe not only the wealth of material now available, but also the first comprehensive account of this valuable material. To the geologist, however, the importance of a fossil plant centres round its value as an index of the age of a stratum. The structure of the relic is to him a comparatively trivial matter, and the name applied to it is no more than a mere symbol. The botanist, on the other hand, is mainly interested in its structure and affinities, for he regards it as a stage in the evolutionary history of plants. To him, therefore, even the name that is applied to a fossil is often a matter of real concern, lest it should convey a misleading impression as to our actual knowledge of its relationships.

My own interest in palaeobotany raises the hope that I may help to bring this fascinating subject more prominently to the notice of my countrymen; and perhaps even succeed in inducing a larger number of them to turn their attention to the rich field that it offers for original investigation. With this end in view I propose to devote my address to a brief review of the present position of Indian palaeobotany.

Before proceeding further I wish to make it clear that by contrasting, as I have done, the geological and the botanical standpoints in palaeobotany, I do not in any sense venture to compare their intrinsic values. And I repeat, as indeed will also be clear from what I have to say, that without the energy and the resources of the Indian geologists the science of fossil plants in this country would have been practically nowhere. At the same time it will, I think, be agreed that it is only by a combination of the two points of view that the best scientific results can be obtained.

HISTORICAL SKETCH.

The history of our knowledge of Indian fossil plants is for the most part embraced by the publications of the Geological Survey of India,[1] which was founded in the middle of last century. Long before that time, however, the great French palaeobotanist Ad. Brongniart (Brongniart 1828, 1828–37) had described a few fossil plants from this country. In 1839 J. F. Royle (Royle 1839), in his well known "Illustrations of the Botany and other Branches of Natural History of the Himalaya Mountains," included figures of some fossil plants, which were subsequently re-examined by the late Dr. E. A. Newell Arber (Arber 1901), who also described (Arber 1905) the British Mu-

[1] Besides numerous references in the earlier volumes of the Journal of the Asiatic Society of Bengal and a few in European journals such as the Quarterly Journal of the Geological Society, the Geological Magazine, and others.

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REFERENCE BOOK

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seum collection of Indian Lower Gondwana plants in his monograph of the Glossopteris Flora. In 1850 McClelland published the "Report of the Geological Survey of India for the session 1848–49" (McClelland 1850) including some figures and descriptions of Indian plant-remains. Ever since then the work of the Survey has been one of ceaseless activity, as is witnessed by the mass of information that is now available on all the different aspects of Indian geology. As regards the palaeobotanical aspect, with which we are here mainly concerned, enough material had already been collected for the completion in 1886 of a monumental work in four volumes, entitled the "Fossil Flora of the Gondwana System" (Oldham and Morris 1863; Feistmantel 1876–1886). This was the result, chiefly, of the labours of Dr. Ottokar Feistmantel; a portion of the first volume had already been published as early as 1863 by Dr. T. Oldham and Prof. O. Morris. The chief value of this work consists in the illustrated descriptions of the more prominent types of Gondwana plants known at that time. The descriptions were based upon collections made in different parts of Peninsular India by Feistmantel himself, by Griesbach, Stoliczka, Waagen, King, the brothers H.F. and W.T. Blanford and many others.

The greater part of what we now know as the Gondwana Flora had thus been worked out before Feistmantel's retirement in 1885. But important additions were subsequently made to the collections of the survey not only from various parts of the peninsula but notably from Kashmir, where plant-bearing deposits of palaeozoic age were first discovered in 1902 by Dr. Noetling at a place not far from Srinagar (see Holland 1903, p. 22). In these plant-bearing strata of Kashmir, Dr. Hayden (Hayden 1907) and Mr. Middlemiss (Middlemiss 1909) recently discovered fresh specimens, and to the latter author we also owe the discovery of a number of other localities in Kashmir where plants of a similar age were found by him only about ten years ago (Middlemiss 1910, 1911).

In the meantime, the science of palaeobotany had made far-reaching progress, both on account of the mass of newly discovered material and of improved methods of investigation. Feistmantel's descriptions and interpretations, although an admirable piece of work at the time of publication, had left much to be desired from the point of view of the modern palaeobotanist. It was therefore desirable that the newly acquired specimens of Indian Gondwana plants should be described, and many of Feistmantel's original types re-examined. This task was carried out in Europe, chiefly by the late Professor R. Zeiller at Paris (Zeiller 1902) and, more recently, by Professor A. C. Seward, with whom I had the privilege of sharing part of this interesting work at Cambridge (Seward 1905, 1907, 1912; Seward and Sahni 1920).

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I have hitherto referred only to the plant-remains of the Gondwana System of India. While these undoubtedly form the bulk of the Indian collections there still remain to be mentioned a very considerable number of plants of Tertiary and Post-Tertiary age. Numerous references to these will be found scattered over the pages of the *Records* and *Memoirs of the Geological Survey* from the earliest volumes onwards. Here are included, for the most part, petrified woods of dicotyledons and monocotyledons, which occur plentifully in certain parts of India and Burma; as well as numerous impressions of leaves, fruits and seeds, also of angiospermous plants. These have come from the Karewa deposits of Kashmir (Godwin-Austen 1864; Middlemiss 1911) and other beds of Tertiary age in the Punjab, Sind, Baluchistan (H. B. Medlicott 1864; Feistmantel 1882; Vredenburg 1908; Pilgrim 1908), Burma (Theobald 1869; Holland 1909, p. 46; Cotter 1908, 1909; Stuart 1910; Pilgrim 1910; Holden 1916), Assam (Seward 1912[1]) and the Bombay Presidency (Wynne 1868, 1869; W. T. Blanford 1872). Lastly, mention may also be made of the geologically quite recent submerged forests on the island of Bombay and on the Tinnevelli coast, which almost bring us to the history of our own times (W. T. Blanford 1878; H. B. Medlicott 1881; La Touche 1920).

I wish to bring the fact prominently to your notice that these Tertiary and Post-Tertiary plants of India practically all remain uninvestigated, and to suggest that they would well repay the trouble of a critical examination.

At the other extreme in point of age we have also a few fragmentary plant-remains recently discovered by Dr. Hayden in the West Himalayan province of Spiti (Hayden 1904). They are of interest as the earliest known Indian fossil plants which are determinable with any approach to accuracy. Their position in the sequence of strata probably corresponds to the Middle Carboniferous of the European stratigraphical scale.

THE NATURE OF THE MATERIAL.

Unfortunately, the plants that have come down to us in the fossil condition are only in rare cases preserved in such a manner as to reveal their internal anatomy—and herein lies the chief difficulty with which the botanist has to contend. This difficulty is all the greater in India, where the number of petrified plants yet discovered is disappointingly small. By far the great majority of Indian fossil plants are merely the impressions of detached leaves or other fragments, and these naturally do not show more than the outward form and the surface features, such as the venation in the case of a leaf. In quite a number of so-called impressions, however, it is possible, after suitable treatment, to make out the structure of the epidermal layer in

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considerable detail; and impressions of sporangiferous fronds will sometimes yield microscope preparations of sporangia and spores which go a long way towards establishing the identity of otherwise unrecognizable fragments. It is needless to emphasize the value of such determinations both to the stratigraphical geologist and to those interested in the geographical distribution of the floras of the past. The investigation of fossil cuticles, although hitherto carried out in a relatively insignificant number of species, has already brought welcome additions to our knowledge of Indian fossil plants (Holden 1915; Seward and Sahni 1920), and promises to yield a rich harvest of results.

PHYSICAL CONDITIONS DURING FORMATION OF PLANT-BEARING DEPOSITS OF INDIA.

Before I pass on to a treatment of the fossil floras of India, it may be of some interest to visualize the physical conditions, climatic and topographical, that obtained during the times when these floras lived and died.

The great triangular peninsula of India, where the majority of the known fossil plants were discovered, is one of the most ancient land-surfaces of the globe. During the Mesozoic era it formed part of a vast continent which stretched from South America, through Africa to Australia. It thus covered the enormous area now occupied by the South Atlantic and Indian Oceans. This Southern Continent, which carries the Indian name of Gondwanaland was bounded on the north by an extensive ocean separating it from an equally vast northern land-mass which joined up the present continents of North America and Eurasia. With the dawn of the Tertiary era, however, there came earth-movements of a violent character. These resulted in a break-up of the Gondwana Continent, the greater part of it being engulfed by the ocean, leaving the isolated peninsulas of South America, Africa, India and Malaya, and the Australasian Archipelago with its island continent of Australia.

These are a few of the fundamental results of a critical examination of the rocks composing the scattered remnants of Gondwanaland; and paleobotany, it may be claimed, has contributed handsomely to their achievement. The testimony of the rocks points unmistakably to an analogy in the physical conditions in India, Australia and South Africa during Mesozoic times.

During part of the Upper Carboniferous age the Gondwana Continent was visited by glacial conditions which have left evidence of their wide-spread character. The extent of the area thus affected can be imagined from the fact that at a level in the stratigraphical scale corresponding to the Upper Carboniferous of Europe there occurs in Australia, India, South Africa

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and even South America a glacial deposit of a remarkably uniform character in all these distant countries. Following this period of intense cold, which must have either destroyed all life or driven the inhabitants to less inhospitable climates, there supervened an era of peculiar earth-movements, resulting in the formation of numerous fresh-water lakes by the subsidence of large tracts of land. The thick series of sediments that were brought down by the rivers and deposited in these lakes are known in India as the Gondwana System of rocks. In these sediments are found buried numerous remains of the terrestrial plants and animals that were swept down by the rivers during periodical floods. The Gondwana rocks, therefore, are a most valuable record of the terrestrial life that existed during the successive geological epochs from the Upper Carboniferous till the Lower Cretaceous.

The geologists further tell us that towards the close of the Cretaceous era an enormous tract of country, of which the present Deccan plateau is only a small remnant, was covered up by an intermittent series of lava-flows which probably welled up from volcanoes of the fissure type. At intervals there occur, between the successive sheets of lava, some fossiliferous deposits of lacustrine or fluviatile origin, known as the Inter-Trappean Beds. These sedimentary beds are, as Prof. Wadia expresses it, "valuable as furnishing the history of "the periods of eruptive quiescence that intervened between "the successive outbursts, and of the animals and plants that "again and again migrated to the quiet centres" (Wadia 1919, p. 197).

The fossil remains of the plants that have lived in these regions since the dawn of the Tertiary era have been discovered in a series of deposits whose outcrops are widely scattered. They have been found in the peninsula of India in Sind, Gujarat, Travancore and along the east coast. In the extrapeninsular area they occur in Burma, the N.W. Himalayas and Baluchistan.

INDIAN FOSSIL FLORAS.

We may pass now to a consideration of the more important types of vegetation that flourished during the successive geological epochs in this part of the earth's surface.

I. Precambrian.

Cuddapah.

Quite recently certain fossils discovered in Indian rocks regarded as of Cuddapah age have been referred to the genus *Cryptozoon* (Vredenburg 1921), which is already known from Pre-Cambrian and later rocks in North America and Australia. The name *Cryptozoon* is misleading, for the specimens are believed to calca-

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reous algae (Pirsson and Schuchert 1920) and not the remains of animals, as the name would lead one to suppose. As regards the Indian specimens, before a thorough examination is made it would be rash to deny their vegetable nature, but the few specimens that I have seen superficially through the courtesy of Prof. H. C. Das-Gupta, do not appear to be convincing.

Vindhyan.

Although supposed traces or plants have been discovered in India in rocks of Vindhyan age, a careful examination has always led to their rejection as evidence of vegetable life (Vredenburg 1908). These so-called "fucoid" markings show only a treacherous resemblance to certain Thallophytic plants, and are in reality probably the tracks of some obscure aquatic animals.

II. Silurian.

Silurian of Spiti.

About sixteen years ago Dr. Hayden discovered some fossils, regarded by him as plant-remains, in the lowermost beds of the Silurian system of Spiti (Hayden 1904, pp. 24, 32), but unfortunately they are so badly preserved that their botanical value is very doubtful.

III. Carboniferous.

Po Series of Spiti.

The earliest Indian fossil plants which it is possible to identify with any approach to accuracy were also discovered by Dr. Hayden in Spiti (Hayden 1904, p. 47). They were collected near the village of Po which is situated on the Spiti River, a large tributary of the Upper Sutluj. The fossils, however, are only fragments of sterile leaves. They were examined by the late Prof. Zeiller who, while hesitating to identify them specifically, compared them to some fern-like plants from the Culm of Australia and Europe.[1]

In the absence of sporangia and other data it is impossible to say whether the plants in question are true ferns or fern-like seed-bearing plants. The meagre evidence afforded by these fragments did not throw much light upon the exact age of the rocks in which they were discovered, but the more recent work of Middlemiss tends to show that the rocks are of Middle Carboniferous age (Middlemiss 1910, p. 223 ; Hayden 1910, p. 261).

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[1] (*a.*) ***Rhacopteris ovata*** McCoy=*R. inaequilatera* O. Feist. (*non* Goepp. sp.) from the Culm of Smith's Creek, Port Stephens, and Arowa, N.S.W.

(*b.*) *Sphenopteridium furcillatum* Ludwig (sp.) from the Culm or Devonian of Hesse-Nassau.

(*c.*) *Sphenopteris rigida* Ludw. from the Culm or Devonian of Hesse-Nassau.

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These fern-like plants are therefore distinctly older than the oldest flora of the Gondwana System.

We come now to the floras of the Gondwana System itself. The accompanying Table (Table I) shows the composition of the more important fossil floras of India.

As a glance at the Table will show, the great majority of the known species of Indian fossil plants come under the Gondwana System, which itself embraces a number of fairly well-marked floras.

I said at an earlier stage that there is evidence of widespread glaciation in Gondwanaland towards the close of the Palaeozoic era. Although primarily derived from the existence of indubitable marks of ice action, this conclusion is supported by the total absence of all signs of life in the deposits in question. But as soon as there was a return to a warmer temperature the desolate waste laid bare by the retreating ice was invaded by life, for in the strata immediately overlying the glacial deposits are found the fossil remains of a few plants and animals.

Talchir : Karharbari.

These plants constitute the Talchir flora, the earliest of the Gondwana Series. The Karharbari stage immediately overlying the Talchir contains a much richer assemblage of plants, and also coal seams—facts pointing to climatic conditions well suited to the growth of a copious vegetation. But the few plants that have been found in the Talchir stage have a special interest attaching to them, for they were among the pioneers of the invading army that was soon to colonize the land.

The question may naturally be asked : Were these early arrivals structurally better fitted than their followers for a place in the vanguard of the advancing host ? If so what advantage did they possess over the others, that enabled them to preceed them in their migration ?

For a complete solution to the question we must await further information about the organisation of these interesting plants—at present our knowledge of them is almost confined to isolated leaves and stems which do not carry us very far. But it has for some time been suspected that at least one of these early Gondwana plants bore seeds that had very much the same appearance as the winged fruit or 'samara' of the modern elm (*Ulmus*). The conjecture is at any rate worth hazarding that the easy dispersal of the seeds through the agency of the wind may have been a factor concerned in the early arrival of at least one of these plants. A number of seeds of this kind, appropriately called *Samaropsis*, have been found in the Talchir, Karharbari, Raniganj and Panchet beds in association with leaves of *Cordaites* and *Gangamopteris*. They have, however, not been seen actually attached to either of these plants. Other seeds of a similar age, differing in the possession

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of a narrower wing, are known as *Cordaicarpus*, but these, like *Samaropsis*, give no clue as to nature of the parent plant. The question of the attribution of all these seeds is therefore shrouded in mystery.

From the Karhabari beds Feistmantel had figured a peculiar-shaped scale-like organ to which Dr. White gave the name *Arberia indica*, and this now becomes especially interesting in the light of a recent discovery. Certain scale-like organs somewhat similar to the Indian *Arberia* were described only a couple of years ago by the Swedish geologist Lundqvist from rocks of a similar age in Brazil (Lundqvist 1919), and these show some *Cordaicarpus* seeds in organic connection. The point that I wish particularly to bring out is that these flat winged seeds are borne upon recurved pedicels suggesting a pendulous attachment favourable for dispersal by the wind. That *Arberia indica* also bore reproductive organs, as hinted long ago by Feistmantel, and, moreover, that they were seeds of the *Samaropsis* or *Cordaicarpus* type, is at any rate a plausible suggestion. But the identity of the parent plant still remains obscure, for *Arberia* itself is only known in the detached condition. The choice seems to lie between *Gangamopteris* and *Cordaites*, with a strong presumption in favour of the latter, for *Gangamopteris* has not been found in India above the Raniganj beds, while both *Cordaites* and *Samaropsis* persist up to the Parsora stage (See Table II.)

It will be noticed from the Table that the Karharbari flora contains a relatively very large number of plants whose affinities are unknown.

In the year 1902 Dr. F. Noetling, then of the Geological Survey (see Holland 1903, p. 22), made an important discovery of Lower Gondwana plants at Khunmu, near Srinagar in Kashmir, thus extending considerably to the north the known northern boundary of the Gondwana continent in this region. Dr. Noetling's small collection from Khunmu, which was later supplemented by Dr. Hayden from the same neighbourhood and by Middlemiss from several other localities in Kashmir, is particularly interesting. Among the half-a dozen species discovered in a short time from Kashmir there are at least two or three which are entirely new to Gondwanaland. Of these, *Gangamopteris kashmirensis* closely resembles *G. cyclopteroides*, but the species of *Psygmophyllum* (*P. Hollandi* and *P. Haydeni*) are not easily identified with any known Gondwana plants. It may be that these species will later on be discovered in more southern regions. On the other hand, it is possible that in this northern maritime province of Gondwanaland, which presumably enjoyed a more equable climate, there flourished a vegetation somewhat different from that in the interior of the continent. Any further light on this question would be of considerable interest.

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IV. Permian.

Barakar.

In the next higher stage, Barakar, two new groups, the Sphenophyllales and the Cycadophyta make their appearance. The Cycadophyta are a phylum of Gymnosperms worthy of note as the most credited ancestors of a race that adopted angiospermy. Although they seem already to have made their appearance in the end of the Palaezoic era, it was not till Jurassic times that they attained their maximum development. The Equisetales are supplemented by the genus *Phyllotheca*; important additions are also to be noticed in two woody stems (*Dadoxylon* spp.) which are the earliest plants with internal structure preserved yet described from India (*Holden* 1917). One of these stems may well have borne the leaves known as *Cordaites Hislopi*.

Ironstone Shales ; Raniganj.

The Ironstone Shales have yielded only some badly preserved plant-remains, but the Raniganj beds overlying them contain a rich assemblage largely made up of plants with net-veined leaves. *Glossopteris* is here seen its best development, several of the species being confined to these beds, while *Gangamopteris*, as far as I know, appears in the Indian flora for the last time.

V. Triassic.

Panchet.

With the end of the Raniganj stage we approach the close of the Palaeozoic era. At about this time the rich vegetation of the Raniganj period appears to have met with adverse conditions, for the rocks of the succeeding Panchet stage have yielded a decidedly poor flora. Indeed there is independent (petrographical) evidence of another period of intense cold at a time roughly corresponding to the Triassic of Europe. We further know from similar evidence that the close of the Lower Gondwana Period, represented by the Parsora stage, was in India probably visited by a dry desert-like climate.

Parsora.

The effect of these unfavourable climatic conditions upon the vegetation of the land is visible beyond mistake. Of the varied assemblage of plants which were responsible for the formation of thick seams of coal in the earlier strata we have now only a few stray representatives. *Glossopteris*, *Schizoneura* and *Cordaites* appear to have been among the hardiest survivors. They trace their history far back in the Gondwana period, and it is interesting to note that *Samaropsis*, as well as certain detached scales with an entire or lacerated margin, have kept them faithful company. This association through these long ages is probably of significance in the correlation of these fragmentary plant-remains.

Perhaps the most remarkable event of this period is the

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appearance in these regions of two new forms, *Cladophlebis denticulata* and *Danaeopsis Hughesi*. Of these the former is a fern that enjoyed an almost world-wide distribution in Mesozoic times, especially in the Jurassic period. *Danaeopsis Hughesi*—a large fern-like frond, which by its whole appearance strikes me as being only a giant *Thinnfeldia*—is characteristic of the Upper Triassic and Rhaetic periods; it has been recorded also from South Africa, Tonkin, China and Australia.

The small assemblage of plants found in the Parsora beds of India is thus full of interest. There is here a mixture of the past and the future: the past is represented by the typically Palaeozoic forms *Glossopteris* and *Vertebraria*, *Schizoneura*, *Cordaites*, *Samaropsis* and the peculiar *Squamae;* the future is heralded by *Cladophlebis denticulata*, a pre-eminently Jurassic species. It is significant that the beds containing this mixed flora were included by Feistmantel in a Transitional Series (Middle Gondwana) intermediate between the Lower and Upper Gondwana.

Taken as a whole, however,—and this is a fact I wish particularly to emphasize—the flora of the Parsora beds of India, shows a much greater affinity with the earlier floras than with that of the Jurassic period.

In a masterly address dealing with the geographical distribution of the former vegetations of the world Prof. Seward arrived at some far-reaching conclusions, one of which I may be allowed to quote:—

"As we ascend [from the Rhaetic] to the Jurassic plant-beds "the change in the vegetation is comparatively slight, and the "same persistence of a well-marked type of vegetation extends "into the Wealden period. It is a remarkable fact that after the "Palaeozoic floras had been replaced by those of the Mesozoic "era, the vegetation maintained a striking uniformity of charac-"ter from the close of the Triassic up to the dawn of the "Cretaceous era." (Seward 1903, p. 837.)

During the seventeen years that have passed since the occasion on which these words were spoken, our knowledge of the floras of Gondwanaland has considerably increased, and this we owe very largely to the work of Professor Seward himself. The truth of the statement just quoted as applied in a general sense, has been demonstrated in the case of several countries whose floras have been worked out more fully in recent years. This general correspondence between the Rhaetic and Jurassic floras is well seen in Queensland. The Ipswich and Walloon series of Queensland have been referred to a Rhaetic and Jurassic age respectively (Walkom 1917, p. 28; 1918, p. 81), but the general facies of the two floras is not very dissimilar.

When we come to the corresponding Indian plant-beds, however, the case is entirely different. Of the half-a-dozen plants known from the Parsora beds, which Mr. Cotter has re-

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cently classed as Rhaetic (Cotter 1917), there is only one species, *Cladophlebis denticulata*, that occurs in the Jurassic rocks. On the contrary, there are at least three important genera, *Cordaites*, *Glossopteris*, and *Schizoneura*, which not only do not occur in India above the Rhaetic, but are represented in the Parsora beds by species that can be traced as far back as the Talchir and Karharbari beds, of Carboniferous age. [1]

There remain only two species, namely, *Thinnfeldia odontopteroides* and *Danaeopsis* (? *Thinnfeldia*) *Hughesi*, and these are generally reckoned as characteristic of Triassic and Rhaetic rocks.

The main point is this: whereas in Europe and elsewhere the revolution from an essentially palaeozoic to an essentially mesozoic vegetation occurred during the course of the Triasso-Rhaetic period, thus dividing the flora of that period into two distinct facies, in India this change did not come about till the end of the Rhaetic age. The entire Triasso-Rhaetic flora of India, therefore, has a uniform and essentially palaeozoic facies, and the change to the Jurassic flora is abrupt.

Before leaving the subject of the Lower Gondwana floras I may draw your attention to two other features in which the Rhaetic flora of India, as far as it is known, differs notably from that of Europe, Australia and other parts of the world. These are, firstly, the entire absence of Ginkgoales, and, secondly, a marked general paucity in the number of species. The contrast is specially strong with Queensland, from which country alone at least thirty-four species have been recorded (Walkom 1918, p. 66; Sahni 1920, p. 21). And it is worthy of note that as many as seven of them are Ginkgoales (species of *Ginkgo* and *Baiera*), while *Cordaites* and *Glossopteris* are conspicuous by their absence.

While this paucity of data regarding the Parsora flora should be taken as a note of caution, the abolition of the Middle Gondwanas as a distinct series, and their inclusion as a part of the Lower Gondwanas—a change recently introduced by Mr. Cotter—is a step thoroughly supported by the available palaeobotanical evidence.

VI. Jurassic.

As soon as we enter the Upper Gondwana period we are transported into a vegetation strikingly different from that of the Lower. The Cordaitales have gone for ever. So also the Glossopterids, along with a host of other fern-like plants, the majority of which are under suspicion as being Pteridosperms.

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[1] Among these species I have neither included *Vertebraria indica* which is known to belong to *Glossopteris*, nor *Samaropsis* and the *Squamae* for these may prove to be portions of *Cordaites* and *Glossopteris*.

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The Equisetales, once an important element in the vegetation, have dwindled to the single genus *Equisetites*, which has a distinctly modern look in contrast to *Schizoneura*. The true ferns now claim an important place, for they are not only more numerous but are sufficiently differentiated to be assigned to a number of recent families. It is noteworthy that all the fern-species, with the exception of *Cladophlebis denticulata*, are different from the previous ones. The Cycadophyta, although they originally appeared as long ago as the Barakar age (Lower Permian), had throughout the Lower Gondwana Period occupied only a subordinate position in the flora. Now they actually dominate the vegetation. But they are not destined long to enjoy this mastery, for a rival group, the Conifers, has also appeared on the scene, and will turn the tables against them in the end. Finally, it is satisfactory to note that the hostile ranks of the *Species Incertae Sedis* have suffered heavy losses.

The sharp contrast between the floras of the Lower and Upper Gondwana which was pointed out long ago by W. T. Blanford (1885, p. 42) is visible at a glance in Table II, which shows the vertical range of the more important genera. The plants have here been grouped according to our present knowledge of their systematic positions. It will be apparent that certain of these groups fall almost entirely in the Lower Gondwanas while the remainder are practically confined to the Upper Gondwanas. The Cordaitales, Equisetales and the Glossopterids, along with a large number of fronds of uncertain affinities, are concentrated in the Lower Gondwanas. The Upper Gondwanas have practically monopolized the Cycadophyta and Conifers, as well as the True Ferns.

I do not propose to enter into detail with regard to the constitution of the Upper Gondwana floras. The rocks correspond in stratigraphical position to the Jurassic and Lower Cretaceous of Europe, and the entire assemblage of plants shows a close general resemblance to the Jurassic and Wealden flora, not only of other parts of Gondwanaland, but also of the northern hemisphere.

Rajmahal; Kota; Jabalpur.

The most important groups of the Rajmahal flora are the Cycadophyta and the True Ferns. In the succeeding floras, Kota and Jabalpur, both these groups suffer a decline and gradually give place to the Conifers, which in the Jabalpur stage occupied much the same position as the Cycadophyta did in the Rajmahal stage, or the Angiosperms do at the present day.

In the Rajmahal stage the Cycadophyta are represented by a large and varied assemblage of fronds, both simple and pinnate, referred to such genera as *Nilssonia*, *Taeniopteris*, *Dictyozamites*, *Otozamites* and *Ptilophyllum*, as well as by a number of flowers called *Williamsonia*. The stem has been

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found in India only in one species, and has been named *Bucklandia indica* (Seward 1917, p. 488); leaves of the *Ptilophyllum* type have been seen in organic connection with it; they left persistent rhomboid cushions on the stem as in the living genus *Cycas*. But it is noteworthy that the secondary wood was compact, the medullary rays being uniseriate (Bancroft 1913).

It may safely be asserted that some of the Indian *Williamsonia* flowers belong to plants having leaves of the *Ptilophyllum acutifolium* type. But as to the organisation of the flowers there is no conclusive evidence: there is a difference of opinion even on such a fundamental point as the unisexual or bisexual character of the flower.

Cycadophytan fronds afford a striking demonstration of the utility of improved methods in the study of fossil plants. According to Prof. Seward "The investigation of the cuticular "structure of various Cycadean fronds ..... has supplied a "basis of classification which affords the best criterion of affi- "nity so far available" (Seward 1917, p. 511). Unfortunately, apart from *Ptilophyllum*, of which the cuticular structure was quite recently described (Seward and Sahni 1920, pp. 21–23) none of the Indian specimens of Cycadophytan fronds have yielded cuticular preparations.

As for the coniferous remains of the Indian Jurassic beds, these are very unsatisfactory from the botanical point of view. The majority of them are vegetative shoots without any clue as to their attribution: they have been placed in a number of form-genera such as *Elatocladus*, *Brachyphyllum*, *Pagiophyllum* and *Retinosporites*. One of the Kota forms has recently been transferred to the genus *Torreyites*, for it shows evidence of two parallel stomatal bands on the under surface of each leaf, as in the living genus *Torreya*. Lastly, there are a few triangular cone-scales, each produced distally into a long and narrow tapering process and bearing a single embedded ovule. These are no doubt Araucarian.

The ferns constitute a strong feature only in the Rajmahal flora, in which there are a number of species referable to the Marattiaceae, Gleicheniaceae, Osmundaceae and Cyatheaceae. Practically all the Rajmahal ferns are confined to this stage.

The great scarcity petrified plants from the Jurassic rocks of India is disappointing, for in rocks of the same age in Queensland abundant petrified coniferous woods and ferns have been discovered (Sahni 1920).

VII. Cretaceous.

Umia.

With the Umia stage we pass into the highest beds of the Gondwana period. Plants have been discovered, so far as I know, only in the upper-

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most beds of the Umia stage, which are interstratified with marine Lower Cretaceous deposits homotaxial with the Wealden of Europe. The general facies of the vegetation continues to be Jurassic, the majority of the known species being identical with those already occurring in the Jabalpur stage. The conifers are all identical with Jabalpur species.

The Cycadophytan fronds include one which deserves more than a passing notice. This is *Taeniopteris vittata*, a species which has long been known from the Jurassic beds of England. Hamshaw Thomas has recently found evidence to show that the English fronds were borne upon a relatively slender axis which was repeatedly forked and carried in the angle of each fork a single bisporangiate flower for which he proposed the new generic name *Williamsoniella* (Thomas 1915).

This dichasial habit is not seen in any modern Cycads but it would seem that it was not a rare feature of fossil cycadean stems.

Reliable data are not yet forthcoming for the identification of the Indian frond *T. vittata* with the English species, but there is a far-reaching agreement in the size, shape and venation —almost the only characters that our Indian specimens reveal. Nor is it clear beyond doubt that the large number of Indian leaves referred to the form genus *Taeniopteris* are all Cycadean. But the existence, in the Umia beds, of fronds closely similar to the Yorkshire species, as well as the large number of Taeniopterids in the Rajmahal flora may, I think, be taken to indicate that we can hopefully look forward to the discovery of Indian fructifications of the *Williamsoniella* type.

Balmir Sandstones: advent of Angiosperms.

The dawn of the Cretaceous epoch was an eventful period in the history of plants, for it marked the advent of a new type that was destined before long to dominate the vegetation of the globe. That this new type of plants possessed important structural advantages over its rivals, may easily be conjectured from the rapidity with which it reduced them to subjection.

In India the earliest Angiosperms been recorded from the Balmir Sandstones of Rajputana, which have yielded some dicotyledonous woods and net-veined leaves (W. T. Blanford 1877; La Touche 1902). These beds are generally assigned to a Jurassic age, but if this should prove correct it would be a fact of considerable interest, because till now the earliest satisfactory records of angiospermous plants do not go further back than the Lower Greensand age. These Balmir plants were mentioned by W. T. Blanford as long ago as 1877. More recently, in 1902, La Touche raised the question of the age of these beds, suggesting that they are probably Cretaceous rather than Jurassic unless, of course, Angiosperms appeared in this part of the world earlier than they did elsewhere.

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The question of the age of the Balmir Sandstones would appear to need further attention, for if the beds are really of Jurassic age it is certainly surprising that no Angiosperms have yet been recorded from the not far distant Umia Beds of Kachh, which are generally agreed upon as being Lower Cretaceous.

Utatur ; Trichinopoly and Ariyalur Beds.

Plant-remains of Cretaceous age have been discovered in the Utatur, Trichinopoly and Ariyalur beds, which are exposed on the Coromandel Coast south of Madras (H. F. Blanford 1862). These fossils are said to consist chiefly of Cycadean woods. One of them is the stem of a tree-fern belonging to the recent family Cyatheaceae. It was discovered by H. F. Blanford and described by Feistmantel under the name *Protocyathea trichinopoliensis* (Feistmantel 1877). R. B. Foote, while describing Cretaceous fossils from the Trichinopoly District mentioned, among other plant-fragments, a fruit-like body which apparently belongs to an Angiosperm (Foote 1879).

Lameta Beds (Infra-Trappean); Inter-Trappean Beds.

The Lameta Beds (Infra-Trappean) have yielded some angiospermous plant-fragments. In the Inter-Trappean sedimentary beds also plant-remains have long been known to occur; these include the fruit-bodies of *Chara Malcolmsonii* Sow. as well as portions of flowering plants, of which the most noteworthy are silicified trunks of palm-trees (J. G. Medlicott 1860, pp. 204–16).

VIII. Tertiary and Post-Tertiary

Our knowledge of the Tertiary and Post-Tertiary plant-remains of India, as I have already said, is very poor, and their satisfactory determination and comparison with recent forms is a difficult task. The material is more fragmentary than ever. Large pieces of petrified wood and, indeed, entire trunks of angiosperm trees have in some places been found in great numbers, but the identification of species from the characters of the secondary wood alone presents difficulties which cannot be adequately met unless there is a consistent system of classifying living timbers on the basis of their anatomical features.

Besides fossil wood (Theobald 1869; W. T. Blanford 1872; Pilgrim 1908, 1910; Cotter 1908, 1909; Stuart 1910; Holden 1916) the only Tertiary plant remains yet known from India are impressions of detached leaves of angiosperms (H. B. Medlicott 1864; Feistmantel 1882; Pilgrim 1910; Seward 1912[1]; *see also* Wadia 1919, pp. 215–16); a few imperfect remains of fruits (Vredenburg 1908, p. 244) and seeds; and, lastly, some fossilized resinous secretions, commonly known as amber (Noetling 1893; Helm 1893; *also* Wadia 1919, p. 206).

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The work of naming and describing these comparatively recent plants, although difficult, is none the less important, for it is here that we find the immediate ancestors of the dominant vegetation of to-day. To those interested in the causes of the present—in many cases very peculiar—geographical distribution of plants, the study of Tertiary and Post-Tertiary floras will serve as a particularly sound basis for speculation. This line of investigation may throw a welcome light upon the question, recently brought into prominence through the work of Dr. J. C. Willis and others, as to whether the wide geographical distribution of a species at the present day may be taken, apart from other considerations, as a sign of the antiquity of its origin.

The most important Tertiary plant-remains are the petrified woods, which appear to belong almost entirely to angiospermous plants, chiefly dicotyledons and palms. Dicotyledonous woods are extraordinarily abundant in the Irrawady System of Upper Burma (Theobald 1869; Cotter 1908, 1909; Holden 1916) which was consequently for many years known as the "Fossil Wood Group," till similar fossils were recently discovered also in the underlying Pegu System (Stuart 1910). These fossil woods of Burma have now been known to scientists for a hundred years, and it is extraordinary that till now the anatomy has been described, so far as I know, only in one single instance. This wood was found to agree in general features with that of modern members of the Dipterocarpaceae, a family well represented in the living flora of Burma. The late Miss Holden therefore aptly named it *Dipterocarpoxylon burmense*. Entire silicified trunks of angiospermous trees have also been recorded by Dr. Pilgrim from the Upper Nari Series of the Bugti and Marri country (Pilgrim 1908); and similar fossils are known from the Siwalik system near Hardwar and a number of other localities (Wadia 1919, pp. 235, 237). Some badly preserved coniferous wood was described long ago by Dr. Schleiden from the Cuddalore Sandstones of Trivicary under the name *Peuce Schmidiana* (Schmid und Schleiden 1855, p. 36).

Impressions of net-veined leaves, presumably of dicotyledons, have been recorded from the Ranikot Series (Eocene) of Sind (*see* Wadia 1919, p. 215), and from the Laki Series (also Eocene) of Baluchistan, Bikaner, Jammu, the Salt Range, Burma and Assam (*see* Wadia 1919, p. 216). In the shaly beds of the Siwalik system numerous leaf-impressions have been discovered. From the Middle Tertiary beds of Assam Prof. Seward described in 1912 a few net-veined leaves which he assigned to the artificial genus *Phyllites* (Seward 1912[1]), and these constitute almost the only published descriptions of Indian Tertiary leaf-impressions.

The only other descriptions of the kind, known to me, are those of certain palm leaves assigned to the recent genus

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Sabal. *Sabal major* Heer, as well as other angiosperm leaves have long been known (H. B. Medlicott 1864, pp. 7–99) from the Kasauli Beds exposed at the well-known hill station of that name. More recently the same species of palm was discovered in the Murree Beds in outcrops near Murree and other places (Feistmantel 1882, p 51; Pilgrim 1910, pp. 205, 188, 226). *Sabal major* has a wide distribution in extra-Indian Tertiary rocks, for example in the Tirol, Bohemia, Italy, France and England. It is interesting to know that the genus still lives in North America. Among its nearest existing relatives are *Corypha umbraculifera* (the Talipot Palm of Ceylon), and the genus *Chamaerops* of which one species is said to occur in the Punjab.

The Tertiary fruits and seeds of India come from the Laki Series (*see* Wadia 1919, p. 216) and from the Pab Sandstone of Fort Munro (Vredenburg 1908, p. 244), the latter being Lower Eocene or possibly Upper Cretaceous in age.

Amber has been recorded from the Middle Tertiaries of Travancore and of Burma. It is well known that amber is often the medium of preservation of some of the most beautiful fossil remains of angiosperm flowers and of insects. But unfortunately neither the Indian amber, nor the slightly different Burmese product to which the special name Burmite has been applied, have yet been found to enclose any fossils. The discovery of such remains in the future is, however, not unlikely.

Karewas.

The well-known table-lands or Karewas of the valley of Kashmir which, covering nearly half the area of the valley, form such a conspicuous feature of the landscape, have generally been regarded as being entirely of lacustrine origin. But on account of their great thickness, reaching several thousand feet, Mr. Middlemiss suggests that only the upper portions of these beds are to be regarded as Pleistocene deposits of lacustrine origin, while the lower sections according to him are probably of Upper Siwalik age. This question is one of those on which the student of fossil plants could throw some light, were adequate material available.

The only plant-fossils from the Karewas of Kashmir of which I have definite knowledge are those recorded from the upper parts of the Karewas which, as Middlemiss has shown, were carried up by the elevation of the Panjal Range. As long ago as 1864 Godwin-Austen recorded some fragments from Gojipatri near Ludar Marg (Godwin-Austen 1864, p. 383). More recently Middlemiss found in the same neighbourhood well-preserved leaves which have been referred to such recent genera as *Quercus*, *Alnus*, *Buxus*, and *Cinnamomum* (Middlemiss 1911, pp. 120–21).

During the interval that has elapsed since these plants

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flourished on the shores of the Pleistocene lake of Kashmir, the flora of this region has undergone considerable changes. The strata in which these interesting fossil plants were discovered have since been raised to an elevation that supports a forest of Pine, Spruce, Fir and, at still higher altitudes, Birch.

None of these Pleistocene plants of Kashmir have been figured or even described from the botanical point of view. The geologist has taken from them practically all he wants; the palaeobotanist has ignored them.

Among the most recent fossil plants of India are the submerged forests of Bombay (W. T. Blanford 1878; H. B. Medlicott 1881; La Touche 1920) and the Tinnevelli Coast. Those on the island of Bombay are said to consist of upright tree-trunks of *Acacia Catechu*, with their roots still planted in their native soil. Geologically speaking these submerged forests are not even as old as yesterday, and to call them fossils is perhaps paying them undue respect. Their interest lies chiefly in showing that there has been a local change in the relative levels of land and sea. *Acacia Catechu* is common in the existing flora of the Western Ghats.

To sum up in a few words, then, the position is this:—

1. The subject of Indian fossil plants was originally treated chiefly from the geological standpoint, and viewed in this light it contributed results that were of value to geologists.

2. The study of the subject from the special view-point of the botanist is an event almost entirely of the present century, but even this brief acquaintance from a different "angle of vision" has shown the importance of the evolutionary aspect.

3. Our knowledge is practically confined to impressions. These, although of great value to those interested in geographical distribution, do not often yield results of morphological value. But the continued investigation of all specimens in which the cuticular or sporangial structure is preserved is bound to be a fruitful line of work.

4. At the same time, the search for petrifactions should be continued with unabated energy, for after all these are the most useful relics for the student of Botany.

5. The greatest gaps in our knowledge are in the earliest and most recent fossil plants. Any discovery of plants older than the Carboniferous glacial period would be of especial interest: a further search in the Po Series of rocks in Spiti in which Dr. Hayden discovered a few plant-remains, would probably well repay the trouble.

6. It is now time that a systematic description and illustration should be attempted of the accumulated material of the Tertiary and Post-Tertiary plants of India.

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CONCLUSION.

In the brief time at my disposal I have attempted to pass in rapid review some of the outstanding features of the extinct vegetations of India. It will be noticed that I have not treated the fossil plants of India primarily according to their grouping in the evolutionary scale, although from the purely botanical point of view this plan would perhaps have been better, in spite of our extensive ignorance of their relationships. On the contrary, I have dealt with them in their natural assemblages, as the rocks of successive ages have handed them down to us. This I have done purposely to emphasize the fact—too often overlooked by those absorbed in the investigation of recent plants—that the vegetation we see around us at the present day is but one stage in the evolution of the plant kingdom, and as such cannot by any means claim our exclusive attention. Every year that passes adds appreciably to the number of known fossil plants, while it may be said without hesitation that the extent to which the study of fossil plants has influenced our conceptions of relationships is out of all proportion to the time spent on their investigation. It is no exaggeration to say that the solution of some of the most fundamental problems in the phylogeny of vascular plants lies buried in the rocks of the earth's crust.

The rapid expansion of the domain of Botany within the last few decades makes it impossible for any one of us to keep a vigilant eye on all the newly acquired territory. While this tends to restrict our fields of activity, and inevitably deprives us of a certain width of outlook it has, let us hope, brought a corresponding gain in a power of critical vision. But from time to time, and of late more often than heretofore, it becomes necessary for us, lest we become permanently short-sighted, to lift up our eyes and cast a glance at the horizons of the kingdom.

Even of our own little province, occasional bird's-eye views, divested of confusing detail, will not infrequently be of value. For they will help in tracing the main directions of past work; in bringing out in relief lines of work that have borne fruit; and, above all, in striking out new paths into obscure and more promising fields.

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Explanation of Table I (Indian Fossil Floras).

While the attempt has been to make this list a fairly complete one, a number of specific names which appeared to have been based upon insufficient or otherwise unsatisfactory data have been omitted.

The species marked thus * are those which, as far as I know for certain, occur *in India* only in the strata against which they are shown. They may thus be of some local importance in fixing the horizons. On the other hand, there are a number of species, each of which occurs in several successive horizons, and these may help in defining the broader subdivisions.

The two thick vertical lines mark the Gondwana system. The subdivisions of the Godwana System are the same as those recognized by the Geological Survey of India. In the column on the extreme left is given the homotaxis of the Indian strata in terms of the European stratigraphical scale.

Explanation of Table II (Vertical Range of Genera of Indian Gondwana Plants).

In examining this table it is to be borne in mind that nearly all the genera are "form-genera," and that their grouping, as here given, is liable to revision on the discovery of fructifications.

The broken lines represent gaps in the known vertical distribution of the genera: These gaps may indicate either:—

(1) a local extinction or migration of the genus owing to unfavourable conditions of life;

(2) that the conditions were unfavourable for the preservation of plant-remains. This is well illustrated by the Ironstone Shales, of which the flora is not such a poor one, but from which very few recognizable plants are known.

or, (3) that a further search will probably fill up the gaps (e.g., *Williamsonia* in the Kota Beds; *Taeniopteris*, at least in the Jabalpur Beds; and *Gleichenites* in the Kota Beds).

An ecological study of Deccan grassland.—*By* W. Burns *and* G. M. Chakradev.

An area of seven acres of the worst Deccan grassland has been leased at Kalas, a village near Poona, in order to make an intense ecological study of plant succession on this type of land.

After fencing and mapping, quadrats were charted, and individual plants and societies observed. The writers deal with the various quadrats.

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describing the plants that arose in each. The area having many types of aspect and soil, the quadrats vary considerably in their flora.

On the higher and more eroded portions the grasses are xerophytic and *Andropogon contortus* dominates. In the lower levels such good fodder grasses as *Andropogon annulatus* are found. Even in the higher parts however *Andropogon monticola* and *Ischaemum laxum* are making progress.

A strip in the middle of the area was ploughed, harrowed and seeded with a special mixture of wild grass seeds. Of these *Andropogon purpureo-sericeus* alone did well, and will probably be the nurse crop for the other plants sown with it. *Lochnera pusilla* appeared in profusion in the cultivated area.

In years of good rainfall there appears no reason why with an improvement of the soil conditions good grasses should not naturally replace the worthless ones. The question of fencing to keep off man and cattle for the times necessary to allow the land to recuperate is acute. Live fences are the only possible ones at present. The welfare of cattle lies at the base of the tillage, milk, manure and money crops, and the improvement of the grass for cattle is a fundamental problem.

The physiological anatomy of the spiked leaf in Sandal (*Santalum album*, L).—*By* P. S. Jivanna Rao.

The paper is in support of the views recently advanced by the author that the spike in Sandal is caused by insufficiency of water owing to relations with unfavourable hosts.

Final solution must be based on (1) experimental proof; (2) evidence of a chemical nature; (3) physiological anatomy of the leaf.

An outline of the third aspect is presented in brief and the discussion centres round the distribution of starch in the spiked leaf. It is inferred that one phase of growth, viz., the division of cells is arrested and the next phase the enlargement of cells is accomplished by increased osmotic pressure. The condensation of starch is connected with the osmotic gradient prevailing in the leaf. The rapidity of growth in spiked twigs is also explained.

Two new species of *Polyporaceae* and some *Polypores* new to Bengal.—*By* S. R. Bose.

This paper is a continuation of the systematic work on Polyporaceae and Agaricaceae of Bengal which I am carrying on. Some of my former works have been published in the Bulletins of the Carmichael Medical College, Belgachia, some in the Proceedings of the Indian Association for the Cultivation of Science, one contributed to the Journal of the Asiatic Society of Bengal is now in the Press, one was read before the annual meeting of the British Mycological Society at Minehead, England, in October 1920, by Mr. T. Petch, the President of the Society, and another is now before the general meeting of the Linnean Society, London, and will, it is hoped, soon be published. Herein I have described two interesting specimens of Polyporaceae which have been confirmed as new species by Mr. Lloyd of Cincinnati, Ohio, U.S.A., who has undoubtedly the largest collection of Polyporaceae from all different parts of the world and have included eight others which are for the first time reported from Bengal.

Detailed description and habitat of the two new species have been given. They are (1) *Polyporus friabilis*, sp. nov., collected from the interior of Hooghly and Howrah districts. It belongs in Section 39 of Lloyd's Stip. Polyporoid pamphlet. It has been named *friabilis* on account of its soft friable context. (2) *Polystictus Sarbadhikarii* sp. nov. collected from the interior of Hooghly district. It is in section close to *Polystictus subcogener*.

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In the case of eight others, new to Bengal, habitat, distribution and full description have been noted. They are:—

(1) *Polyporus nilgheriensis*, Mont.
(2) *Polyporus anebus*, Berk.
(3) *Polyporus fumoso-olivaceus*, Petch.
(4) *Polystictus protea*, Berk.
(5) *Polystictus Berkeleyi*, Bres. Formerly it was named as *Hexagona pergamenus* by Berkley, Bresadola changed it to *Polystictus* Berkeley, but it is more a Hexagona than a *Polystictus*.
(6) *Fomes leuco-phaeus*, Mont, this is a crust from and malformation of *Formes applanatus*.
(7) *Trametes Muelleri*, Berk.
(8) *Hexagonal Daedalea flavida*, Lev.

Ecological details have not been given here, as it is hoped to deal with them in a future paper.

The leaf apex in rice.—*By* H. M. Chibber.

The tips of leaves like any other part of a plant present characters that can be utilised for distinguishing closely related strains of a variety. Observations on this point are made on a certain variety of rice growing in Bombay.

Spore-forming habit of the Heterocysts of *Gloeotrichia indica*, Schmidle.—*By* S. L. Ghose.

1. Description of the habit, the thallus, filaments, spores and heterocysts of the alga.

2. A few cytological observations on the structure of the heterocyst.

3. Some heterocysts burst out and produce an 'aplano-spore-like' body. Sometimes two of these are formed. Again, the further one of these may germinate into a large resting-spore with an heterocyst attached to it at the free end. In some other cases this second 'aplano-spore' seems to degenerate at some distance from the first and thus throw the heterocyst, which is at the end of it, to some distance.

4. Conclusion.—Even at the present day in healthily growing forms the heterocysts of *Gloeotrichia indica* seem to have kept up their original function of gonidangia, which other members of the Myxophyceae seem to have lost long ago.

Note on two Indian species of *Trentepohlia*.—*By* M. O. Parthasarathy Iyengar.

Trentepohlia is pre-eminently a tropical genus of sub-aerial green algae. Though as many as nine species of this genus have been recorded from Burma and seven from Ceylon, not even a single species seems to have been recorded from India proper.

Two species have been collected by the author from Trivandrum and one from Calcutta. Their descriptions are given in the paper.

The absence of *Trentepohlia* on the Madras coast is rather interesting and is probably due to the rainfall there not being sufficiently heavy for its occurrence. A filamentous green alga, a species of *Rhizoclonium*, however, grows there in typically sub-aerial situations. But since it does not develop a screening pigment in its cells like the hæmatochrome of *Trentepohlia*, it is, unlike the latter, not able to maintain itself in exposed and illuminated places, but is able to live only in very shady situations.

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The distribution of liverworts in the Western Himalayas, Ladak and Kashmir.—*By* Shiv Ram Kashyap.

The facts relating to the distribution of Liverworts as observed during a recent journey through Chamba, Lahoul, Ladak, Kashmir and Jammu are described. The only Liverworts met with in Ladak were *Plagiochasma articulatum* and *Marchantia polymorpha*. The latter shows some peculiarities in its structure. The number of Liverworts in Kashmir is very much smaller than in the eastern part of the Western Himalayas. The chief forms met with were the following:—*Marchantia nepalensis*, *Fegatella conica*, *Pellia calycina*, *Fimbriaria reticulata*, one or two species of *Porella*.

In the Jammu territory the following forms were met with: *Marchantia nepalensis*, *Fimbriaria mussuriensis*, *Reboulia hemispherica*, *Plagiochasma appendiculatum* and *P. articulatum*, *Grimaldia indica*, *Athalamia pinguis*, *Riccia sanguinea* and *R. himalayensis*, *Pellia calycina*, *Porella*, another foliose form and *Anthoceros himalayensis*.

The law that the number of Liverworts falls in passing from the east to the west in the Western Himalayas holds good for Kashmir also.

Cycas revoluta and *Cycas circinalis*.—*By* Shiv Ram Kashyap.

Observations on the leaf-clusters and ovules of *Cycas revoluta* are described, and a curious tree of *Cycas circinalis* with unusual branching is also mentioned. The following conclusions are arrived at:—

(1) In *Cycas revoluta* one to three leaf-clusters may appear every year in very young plants; in older plants one cluster appears every year; in still older plants one cluster appears every other year.

(2) Occasionally ovules of *Cycas revoluta* develop a fully-formed endosperm and archegonia although no male plants are found in the neighbourhood.

(3) Intermediate forms between the fertile sporophylls and scales occur in *Cycas revoluta*.

(4) A dichotomously branched tree of *Cycas circinalis* is described.

The presence of a "tent-pole" in the seed of *Cephalotaxus pedunculata*.—*By* B. Sahni.

In a paper communicated to the Botany Section of the Congress last year (since published in the Annals of Botany, Vol. 34, 1920), the author brought forward some evidence for the view that, apart from *Ginkgo*, the nearest known relatives of the Taxineae are among the Palæozoic group Cordaitales. The present paper records another feature in the seed of one of the Taxineae (*Cephalotaxus pedunculata*), which appears considerably to strengthen the Cordaitalean affinity. This is the presence of a small apical prolongation of the female prothallus, which, surrounded by depressions into which the archegonia open, supports the nucellar membrane as a tent-pole supports a tent. The comparison of this terminal peg-like outgrowth to a tent-pole was originally made by Hirasé, who described it in *Ginkgo biloba*, which, according to the present author, is the nearest living ally of the Taxineae.

This organ has been known as a peculiar characteristic of seeds having Cordaitalean affinities, and its discovery in *Ginkgo* was naturally regarded as a point of contact between the recent genus and the extinct group. The author considers it likely that if other members of the Taxineae are examined from this point of view, a "tent-pole" will be found in one or more of them.

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On a new abnormality in the sporophyll of *Tmesipteris*.—*By* B. Sahni.

The abnormal structure in question was noticed in the New Caledonian form, *Tm. Vieillardi*, Dangeard. It is well known that while the normal synangium of *Tmesipteris* is bilocular, occasionally there occur trilocular synangia similar to those of the allied genus *Psilotum*. The abnormality here recorded consists of two trilocular synangia, one borne on a two-lobed (that is, normal) sporophyll, and the other borne on a three-lobed sporophyll, *the three-lobed sporophyll arising as a ventral (adaxial) branch of the two-lobed one.* The entire structure may be described as a twin sporophyll consisting of a dorsal and a ventral individual. In the case of the three-lobed sporophyll the lobes occupy the depressions between the three loculi. All the six loculi are fertile and apparently healthy.

The vascular supply to the entire abnormality originates as a single large strand constricted off tangentially from one of the strands forming the xylem-ring of the stem. This strand soon divides tangentially into two equal bundles, one supplying each individual of the twin sporophyll.

Female prothallus of *Pinus longifolia*.—*By* M. L. Sethi.

The female prothallus in this species is a cylindrical body about 10 mm. in length, slightly compressed from two sides, the shorter and longer diameters being about 2·3 and 2·6 mm. respectively. The micropylar end bears the archegonia, the number of which varies between 2 and 7; 3, 4 and 5 being the commonest numbers. The fertile end bearing the archegonia may or may not be slightly constricted. The archegonia appear as small oval bodies visible to the naked eye. Their necks open towards the apex of the prothallus. The prothallus is generally lobed in the peripheral region and may be invaginated also.

Notes on abnormal female prothalli of *Pinus longifolia*.—*By* M. L. Sethi.

No. 1.—This prothallus was collected at Lahore on the 10th May, 1920. It was very much compressed from side to side, the archegonia being aggregated towards one flat side. The internal structure of these archegonia was investigated in serial transverse sections.

In all, eleven archegonia were counted in the prothallus, the largest number recorded so far being 9 in *P. montana* var. *uncinata*, while in other species worked out by Miss Ferguson (Proceedings of the Washington Academy of Sciences, Vol. VI, 1904), the number ranges from 1 to 5 (the usual number being 3). As many as 9 archegonia were counted in a single section. All these archegonia opened towards the side on which they were situated and not towards the apex as is generally the case. All the eleven archegonia were fertile. Four of them were at different stages of fertilization, while in a fifth case two nuclei (presumably male) were seen below the neck. All the rest showed the big female nucleus close to the centre of the archegonium ready for fertilization.

All the archegonia of the prothallus were normal except one which had given out a bulge on one side, the bulge having neither a neck nor a nucleus of its own. The bulge is at some levels as broad as the archegonium itself but at other levels below and above it is smaller. Moreover, being much smaller than the main archegonium, it does not extend throughout the length of the archegonium to which it is attached.

No. 2.—I also came across some other abnormal prothalli. One was just like the one described by Saxton in *Pinus maritima* (Annals of Botany, July 1912). In this prothallus there were three archegonia disposed laterally. Their necks opened towards the side and not towards

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the apex. Their longer axes were not parallel with the axis of the prothallus but were rather oblique.

No. 3.—This was in reality a transitional case between No. 2 and a normal prothallus. In this case there were three archegonia, two disposed laterally and one at the apex.

On a peculiar mode of germination of the seed in *Eugenia jambolana*, Lamk.—*By* N. K. Tiwary.

During the rainy season of 1919 some seeds of *Eugenia jambolana*, Lamk, were noticed in the process of germination, and on examination it was found that in several cases there was a departure from the normal type of germination found in Dicotyledonous seeds, several seedlings being produced, in some cases, from one seed.

The seeds are roughly oval or spindle shaped, and vary much in length. They have a smooth testa and are exalbuminous. Some have embryos of the normal dicotyledonous type, but others have a number of embryos each with a pair of cotyledons. *The size, shape and arrangement of the cotyledons varies within very wide limits.*

The germination takes place in abundant moisture, the testa cracking irregularly, followed by the elongation of the radicle and the plumule. The sequence of germination of the different embryos in the case of polyembryonic seeds is variable. In some all the embryos seem to germinate almost simultaneously, but in others some get a start over others. In a few instances the awakening of the last embryo did not begin until the first seedling was far advanced, having already produced a number of leaves.

Detailed study is proceeding on the following lines:—

(1) The relation of the embryos to the contents of the embryo-sac.
(2) Early stages of fertilisation and the development of the different embryos.
(3) The relation of the different embryos to each other.

An instance of a short-cut to the nectary of a flower by a Madras bird.—*By* M.O. Parthasarathy Iyengar.

A sunbird (*Arachnechthria lotenia*) generally visits flowers in Madras for the sake of the honey in them; and in the process of sucking out the honey, naturally brings about cross-pollination. But in one case, viz. *Quisqualis indica*, its visits are not beneficial to the flower. The honey in this flower is stored in the long calyx tube. The beak of the bird is not long enough to reach the honey in the calyx tube. So it simply cuts a hole in the lower part of the calyx tube from the outside and sucks out the honey.

Note on a bulbiferous coconut tree from Malabar.—*By* M. O. Parthasarathy Iyengar

The paper describes a coconut tree in Malabar which does not bear fruits nor flowers, but in the place of the inflorescences produces short-lived leafy shoots (bulbils). These branches grow for some time and ultimately drop off. (A similar case has been described by Ridley from the Malacca Peninsula.)

Attempts were made by the author to grow these bulbils in the ground but without success.

A careful examination of such bulbils throws some light on the morphology of the spathe of the coconut inflorescence which appears to be the basal portion of an ordinary coconut-leaf which, owing to the change in its function, viz. protection of the inflorescence inside, has become scaly and has not developed its upper leafy portion.

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Variability of *Evolvulus alsynoides*.—*By* G. M. CHAKRADEO.

(1) The subject arises out of the research work in connection with the Deccan grass-land at the Experimental Station of the Bombay Agricultural Department, a few miles off from the Poona Agricultural College.

(2) The species is one of the first occupants of the grass land during the early rains.

(3) The blue flowered variety is the normal one so far described in the Bombay floras. Two more distinct varieties discovered :—

(1) The white ; (2) The heliotrope.

But a number of variations are also found—about a dozen in number—with various distinct shades of colour intermediate between those above. Other variations of form shape and size also occur in the species.

(4) The plants collected from various places far and near Poona show a wide variation of its habitat, viz. from bare rock to simple waste bad lands and murum. The plant is typically a xerophytic one.

(5) Various positions from erect to trailing observed in the plants of the species.

(6) Flowers opening in the morning from 7 to 8 a.m. and closing in the afternoon between 4 and 5 p.m. Both times subject to alterations on either side

(7) Possibilities of the various usefulness of the plant suggested, viz. :—

(i) Flowers may be utilized for extracting blue colour or various other shades also.

(ii) Plant adaptable to garden conditions and can be added to the ornamental stock of an horticulturist.

(8) Species is normally adapted for self-pollination.

Fungi of termite-nests from Berkuda Island, Chilka Lake, Madras.—*By* S. R. BOSE.

In the island of Berkuda there are four species of termites which cultivate fungi for food, viz. (1) *Termes* (*Odontermes*) *obesus*, Ramb., the most abundant species in the island (2) New genus ? from the tallest mound about 6 ft. high (3) and (4) *Microtermes* spp. ?. Dr. Annandale has sent all these different species to Prof. Silvestri of Italy for identification.

Three forms of combs are interesting as illustrating regular progressive development : (1) *Microtermes* cultivate its mushrooms on a manure-bed, there are no separate cells on the comb which is almost an amorphous mass ; (2) the new genus ? forms elongated irregular chambers on the comb ; (3) finally in *T. obesus* a more orderly arrangement of cells on the comb has been obtained.

Some fresh combs were cleared of termites and kept on a moist blotting paper under the cover of a bell-jar. In course of two days, white upright stalks of *Xylaria* sp. came out, they were about 10-20 cm. long and were strongly heliotropic. These white stalks, soon (in course of two days) turned black and the black colour travelled from the base upwards till in course of a week everything turned black except white apices. The white tips became variously branched (some 6 to 8 divisions were found) and ultimately became conidioferous, a section under the microscope showed conidial layer on the outside, no perithecia were seen. In course of 12 to 14 days the stalks began to collapse and they were attacked externally by yellowish and white rounded patches of parasitic Mucor in some combs there was sudden growth of an *Agaricus*, *Coprinus niveus* and in one case there were no *Xylaria* stalks produced.

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but the white mycelial mass of sessile spheres turned green and remained the same throughout, like green rots on decomposed woods. The culture of *Xylaria* sp. under bell-jar was kept on for more than two and half months by daily watering.

About half a dozen cultures of *Xylaria* spp. from different termite combs under bell-jar were carried on. The general results were almost the same, the minor differences noted were regarding the lengths of *Xylaria* stalks and their comparative thickness, they are all probably the same species of *Xylaria*; they have been sent to C. G. Lloyd of America for identification. During this culture-period, the maximum temperature ranged from 88° to 81°F. and the minimum ranged from 74° to 68°F.

From the above ground part of the nest of *Termes obesus* were collected in July 1920 a good number of big white mushrooms with a spreading umbonate cap and stalk about 16 cm. long and with spores pink, oval, 8×4 μ, probably belonging to the genus *Pluteus*. These white *Pluteus* spp. are the only fungi which appear for a short time during the rainy season from the mounds which are full of living termites (*T. obesus*); in no case do they produce *Xylaria* stromata on combs *in situ*. But some short firm black stalks of *Xylaria* sp. were collected from a piece of dead wood sticking to the outer wall of the tallest mound of the new genus and from the dead prostrate trunk of the *Ficus bengalensis* and from logs here and there, close to these mounds. They have also been sent to Mr. Lloyd of America for determination.

Mr. Petch, the mycologist of Peradeniya Bot. Gardens, Ceylon, has written a masterly account of the fungi in termite nests in Ceylon in Annals of the Peradeniya Royal Bot. Garden, Vol. III, from page 185 to 270 with 17 good plates. His conclusions mainly are that the termites maintain a pure culture, that they weed out all foreign fungi except the edible one (which might be either *Lentimus*, *Collybia*, *Pluteus*, *Pholiota*, *Flamula* or *Armillaria* and which forms the chief edible variety amongst the Cinhalese), but that *Xylaria nigripes*? defies their efforts to exterminate it and that it is only kept under and all other fungi which develop in cultures subsequently, are due to infection after removal from the nest.

And this is fully borne out in our case when we consider the case of *Xylaria* stromata growing on logs, sticking to the outer wall of the termite nest and on dead prostrate trunks and rotten wood here and there in the vicinity of the termite nests. This lends additional support to the theory of *Xylaria* mycelium vegetating in the comb substance; as soon as its spores or mycelia come just on the outside and become removed from the control of the termites, there they get their free growth and reach their final reproductive stage. Numbers of *Xylaria* stromata in the vicinity of the termite hills in Berkuda, Chilka lake, are probably due to mycelia or spores of *Xylaria*, being easily carried from the nests by various mites, insects or ants. A number of sections of intestines of different types (workers and soldiers) of different species of termites show presence of fragments of some fungal hyphae, oval spores and some wood vessels (spiral, reticulate, etc.), they show how the fungi are propagated from nest to nest.

Chemical analysis of the long-stalked white mushrooms (*Pluteus*) from the termite nests shows that they contain 2·25 per cent proteids, 1·2 per cent carbohydrates and fats, ·21 per cent; it could not be ascertained whether they are edible or not, as the island is uninhabitated by any human being.

Notes on the plant ecology of Tehrí, Garhwál State.—*By* L. A. Kenoyer *and* Winfield Dudgeon.

Tehri, Garhwál State, has an area of about 4,200 sq.m. lying entirely withinthe Himalayas. The topography is very rough: elevations range

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from about 2,500 ft. in the Ganges valley at Hardwar to peaks above 23,000 ft. on the Thibetan border. The Ganges and Jamna rivers traverse the State roughly from north to south. The mountains rise abruptly from the plains to a height of 6,000-7,000 ft.; the next succeeding ranges are little higher till near the great snowy peaks, when the elevation rapidly increases. Rainfall is high on the outer faces of the outer ranges, and on the outer faces of the high ranges; north-facing slopes, valleys and the flanks of the intervening ranges receive much less rain, or are in places arid Snow falls down to about 5,000 ft., and frosts occur at about 4,000 ft.

This paper is based on observations made on a trip to the headwaters of the Ganges during the summer of 1920, supplemented by extended observations about Mussoorie, Naini Tal, and back to the snows in Kumaon.

Forest Types.

The climax vegetation throughout Tehri Garhwal State is forest. There are several types of forest, depending on humidity (rainfall, exposure to insolation, and drainage) and temperature (due to altitude, latitude, insolation, and topography).

A. Monsoon forest formations: climate sub-tropical, markedly periodic, with heavy summer monsoon.

1. Jungles of tall grasses, 500–1,000 ft., on the terai.
2. Fine forests 1,000–1,500 ft. on the bhabar. These are a direct continuation of the Himalayan forests, but lie outside the area under consideration.
3. Shorea robusta forests, 1,500–2,500 ft., on the outer slopes and to a very limited extent up valleys. The final forest is an almost pure dense stand of *Shorea robusta.*
   Pioneer forests contain *Mallotus philippinensis, Anogeissus latifolia, Murraya koenigii, Cassia fistula, Trewia nudiflora, Celtis australis.*
4. Upper monsoon-deciduous forests, 2,000–5,000 ft., below severe frost, and now, in warm and relatively humid locations; extends far up river valleys, and up protected ravines. Dominated by *Bauhinia variegata, B. retusa, B. vahlii, Grewia asiatica, Terminalia chebula.*
   Pioneer shrubs: *Euphorbia Royleana, Carissa spinarum, Justicia adhatoda, Rhus parviflora, Glochidion velutinum.*
   Pioneer forest: *Nyctanthes arbor-tristis, Erythrina suberosa, Sapium insigne, Odina wodier, Premna latifolia, Garuga pinnata.*

B. Broad-leaf sclerophyll formations; 4,500–11,000 ft.; climate temperate, and periodic, monsoon in summer, humidity relatively high.

5. Quercus incana-Rhododendron arboreum forests, 4,500–8,000 ft.: on mountain crests, northern slopes, and in protected ravines. A dense shady forest dominated by *Quercus incana, Rhododendron arboreum, Pieris ovalifolia,* and characterized by occurrence of *Ophiopogon intermedius* and *Polystichum aculeatum.*
   Hydrarch pioneers (along stream and wet flats): Lauraceae, *Cornus capitata, Sarcococca pruniformis.*
   Xerarch pioneers (on ridges and drier places): *Berberis lycium, Rosa moschata. Indigofera gerardiana, Rubus ellipticus, Crataegus crenulata, Pyrus pashia, Prinsepia utilis.*
6. Pinus longifolia forests, 3,500–7,000 ft., on exposed, well-drained, and south-facing ridges, an edaphic forest in places too dry to be occupied by either the upper monsoon-deciduous or the Quercus incana-Rhododendron arboreum forests, but clearly

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within their range. Dominated at all stages by a parklike open forest of *Pinus longifolia*, with a grassy floor sparingly occupied by the xerarch pioneers of the Quercus incana forests.

7. Quercus dilatata forest, 7,500–9,000 ft., overlapping the upper edge of the *Q. incana*, and the lower edge of the *Q. semecarpifolia* forests, and containing the occasional trees found in them.
8. Quercus semecarpifolia forest, 8,500–11,000 ft., precipitation more uniformly distributed, good fall of snow in winter, and humidity relatively high; confined to peaks south of the snowy range. A dense forest with scanty undergrowth, dominated by *Quercus semecarpifolia*, with some *Rhododendron arboreum*, *Evonymus lacerus*.

C. Coniferous and winter-deciduous forests, 7,000–13,000 ft., precipitation fairly well distributed, winter snowfall heavy, and cold severe.

9. Cedrus deodara forests, 7,000–11,000 ft., climate rather dry, and humidity relatively low. Dominated by a dense close stand of *Cedrus deodara*, with scanty undergrowth of *Abelia trifolia*, *Viburnum cotinifolium*, *Rosa webbiana*, *Jasminum humile*, *Berberis vulgaris*.

Pioneer hydrarch forest at lower levels, 7,000–9,000 ft. *Betula alnoides*, *Alnus nepalensis*, *Ulmus wallichiana*, *Acer caesium*.

Pioneer hydrarch successions at higher levels, 8,500–10,000 ft.

Deciduous pioneers; *Acer caesium*, *A. pictum*, *Corylus colurna*, *Betula alnoides*, *Salix spp.*, *Populus ciliata*, *Hippophae rhamnoides*.

Coniferous pioneers: *Pinus excelsa*, *Picea morinda*, *Cupressus torulosa*.

Xerarch pioneers (on talus slopes): *Abelia trifolia*, *Lonicera quinquelocularis*, *Spiraea sorbifolia*, *Ribes grossularia*, *Rosa webbiana*.

10. Abies webbiana-Betula utilis forests, 10,000–13,000 ft. Humidity relatively high. This forest merges into *Quercus semecarpifolia* south of the snowy range, and into *Cedrus deodara* on and north of the snowy range. It consists of *Abies webbiana*, more or less mixed with *Betula utilis*, passing into pure stand *Betula* at higher levels, with a fringe of *Rhododendron campanulatum*, *Cotoneaster microphylla* and other shrubs near the upper limit of trees.

D. Formations above tree-line; growing season too short for trees to become established.

11. Juniperus Ephedra gerardiana scrub, scattered over less precipitous mountain sides and southern exposures.
12. Alpine meadows: snow-free period during summer too short to permit growth of woody vegetation. Dominated by grasses and annual and perennial herbs.

Seasonal Phenomena.

The climate is strikingly periodic over most of the area. Winter is temperate and dry up to 5,000 ft. and cold and more or less snow at higher altitudes; spring is dry and sunny, and at high elevations limited to a very short period; summer is rainy and humid; autumn is dry and sunny.

Each climatic season exerts a marked effect on the vegetation—in the periodicity of vegetation and reproduction of the woody plants, and

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in the time of appearance and facies of the herbaceous plants. Spring vegetation is probably most typical of the area; summer brings tropical species and aspect: autumn is temperate in species and aspect.

Influence of Man on the Vegetation.

The population averages only about 64 per sq. m., but is concentrated in the fertile valleys and on gently sloping mountain sides. The forests are ruthlessly exploited about villages—cleared for cultivation, cut for fuel, fodder and thatching, for the most part severely grazed, and often burned over. Along trade routes into Thibet, exploitation is especially severe and irresponsible. The accessible forests of *Pinus longifolia*, *P. excelsa*, and *Cedrus deodara* are exploited for timber, with as yet little effort at replacement.

Instances of syncarpy in *Mangifera indica*, L., and some other tropical plants.—*By* P. M. Debbarman.

Two interesting specimens of mango fruits exhibiting syncarpy have recently come under my notice. One was sent by Mr. S. N. Roy from Pabna and the other was collected by myself. In the former three small ones and the later a small one partly coalesced with a big one. With a view to decide whether the fusion was due to adhesion between the pistils of separate flowers or any other cause, these specimens were dissected and it was found that not only the epicarpic layer, but the mesocarpic layer too was continuous and there was a definite organic connection between the contiguous endocarps. The partial union of the fruits by their bases only and the presence of the divergent apical lobes, lead us to conclude that the adhesion between the originally distinct but contiguous pistils must have taken place at quite an early stage. In such teratological literature as I have been able to consult, I have not found Mangifera indica cited or described in connection with syncarpy and its allied deviations. So the present cases seem to be worth placing on record. Mention has been made in this connection of a few other tropical plants in which syncarpy has been noticed by me.

A study of the floristics and ecology of Lucknow.—*By* S. K. Mukerji.

The present account is an attempt to give an idea of the flora and some interesting ecological observations of Lucknow and its suburbs.

(1) *General features and situation of Lucknow.*
(2) *Geology, climate and rainfall.*
(3) *List of plants—(according to Engler's system).*
(4) *Some points where I differ from Hooker and Duthie.*
(5) *An account of seasonal succession of plants.*
(6) *Ecological observations on the following habitats:—*
  (i) Chunhat Lake.
  (ii) Marshy tract near Mohan Lal Gunj.
  (iii) Gomti and its banks.
(7) *Various associations of the "Savannah formation" from Bundelkhand to the foot of the Himalayas.*
(8) *Human influence on local vegetation.*

The Dal Lake (Kashmir): a study in biotic succession.—*By* S. K. Mukerji.

The purpose of this paper is to trace the hydrarch succession in and from the Dal Lake; briefly to determine the climatic climax for this part

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of the Himalayas, and the various successions leading up to it; and to show the influence of man and other biotic factors on the vegetation of the area.

(1) *General features and situation of the Dal.*
(2) *Geology, climate and rainfall of the district.*
(3) *Plant communities :—*

The plant communities of the lake region culminate in different 'climax' of vegetation in different localities, but the following are the general features.

I. Aquatic formation.

(*a*) *Deep Water Association*—dominated by Potamogetons, Hydrilla, Myriophyllum, etc., chara, forming a dense carpet on the bed.
(*b*) *'Floating-leaf' Association* or *Shallow water Association*—dominated by Trapa, Nelumbium, Nymphaea, Euryale ferox, etc.
(*c*) *Reed-Swamp Association* — dominated by Typha, Sparganium, Carex, etc., which along with plants of 'Floating-leaf' Association, form various '*Consocies.*

N.B.—*a, b, c* all show various 'Consocies' and 'Societies.'

II. Marsh Formation.

(*a*) *Herbaceous Marsh Association* — dominated by Ranunculus aquatilis, Callitriche, Hippuris, Ceratophyllum, Juncus etc.
(*b*) *Salicetum Association*—willows sometimes poplars, etc., with an undergrowth of perennial herbs. These form 'demp' land.

III. Meadow Formation.

Dominated by grasses and perennial herbs.
The *demp land* and meadow stage are converted inte arable land by man.

IV 'Gravel Slide' Formation or '*Xerophytic Bushland' Formation.*

The meadow stage on the eastern and southern shores of the Dal ends in 'Gravel-slide' Formation—Rubus, Rosa, Crataegus, Astragalus, etc.

V. Mesphytic Bushland Stage or *Shrub Stage.*

In the Arrah valley near Harwan—Viburnum, Prunus, Salix, Rosa, Ribes, etc.

VI. Pioneer Conifer Forest.

Higher up the Arrah Valley from Harwan upwards is developed a conifer forest on the mountain sides. Pinus excelsa is the pioneer. Few plants of Cedrus Deodara occur, mixed with many shrubs.

VII. Climatic Climax Forest.

Still higher up at an elevation of about 8,000 feet is developed a climatic climax deodar Forest.

(4) The view that 'Succession proceeds from extremes where there is either too much or too little water towards the Mesophytic and the highest stage of development is forest' holds good very well for this particular region.

(5) If the view, held by Lydekker, who, after a careful study of the formation of upper and lower KAREWAS, came to the conclusion that Kashmir was once covered by the waters of a vast lake, be true, then my contention is that the Chashmashahi Reserve Forest is the culminating point of the 'Dal succession,' although now, since the level of the

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lake has much fallen, people might argue that the said forest growing at a height of about 8,000 feet is the climax of a 'mountain succession.'

(6) The Dal lake is drying up on account of—

(*a*) centripetal encroachment of willows and other marshy and swampy vegetation.

(*b*) Rain and melting snow on the surrounding mountains bringing lot of silt and mud.

(*c*) Arrah river falling into the Dal and bringing huge quantities of suspended matter.

(7) *Periodicity in vegetation and flowering.*

(8) *Influence of man in changing the character of vegetation and disturbing the balance subsisting between the various communities of plants.*

Section of Geology

President:—D. N. Wadia, M.A., B.Sc., F.G.S.

Presidential Address.

I. The Position of the Science of Geology in India.

The work accomplished by the Geological Survey of India.

The Geological Survey of India was instituted as a separate Scientific Department in the year 1856, with the principal object of preparing a general geological map of the country; it is now sixty-five years since it commenced its labours in this vast and untrodden field of exploration such as India offered in those days, with a number of workers which looks small in comparison with the scientific force employed in the Geological Survey of a single State of the United States of America. But the labours of this small band of scientists, unsupported by any outside help or co-operation (with a few honourable exceptions) have already borne fruit, for not only have the foundations of Indian Stratigraphy been securely laid, and its frame-work built in a way such as future research is not likely much to alter—except in matters of detail—but a large volume of data has been accumulated which will furnish the basis for future work and guide its development. The results achieved in Spiti and Kashmir, elucidating the stratigraphy of these sections of the Himalaya and revealing the comparative simplicity of its geotectonics; the researches in Tertiary stratigraphy and palaeontology in the Sind-Baluchistan frontier and in the Punjab, the brilliant work done in connection with the Oil of Burma and its other economic minerals; the petrological and mineralogical researches, commenced about fifteen years ago, in connection with the rock-complexes and ore-bodies of the Peninsula, all testify that the laurels won by the Pioneers of the last generation have been worthily maintained by their successors of the present generation.

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Economic Geology, mineralogy, petrology, etc.

But though there is every reason to feel satisfaction at the results already accomplished, especially in the Areal, Structural and Stratigraphical branches of geology the work which yet awaits geological research in India is immense both in its scope and possibility. Up till lately the progress of geological investigation in India was mainly in the direction of stratigraphy with its concomitant palaeontological research. The departments of Petrology, Mineralogy, Physiography, Economic Geology were suffered to remain in abeyance, comparatively speaking, till Holland's researches, about the beginning of the new century, initiated a new chapter in the official Year-book. Since then notable work has been done in these branches both in the great archaean terrain of South India and in Burma to fill up the deficiency, if only in part. The Geological Survey of Britain was established in 1832, i.e. a quarter of a century before the Indian Survey commenced its operation and yet with its corps of distinguished specialists in all branches, and with the large and steady measure of able amateur co-operation, one can easily see from its annual programmes of work how much still remains for investigation in the Geology of the British isles, especially in the above-mentioned departments, which now claim a first rank in the publications issuing from the Geological Surveys of all advanced countries of the world.

Lack of Amateur Co-operation.

In a country like India, therefore, where the ground to be covered is so vast and the workers so few, this disproportion between the work accomplished and that which yet awaits accomplishment is much greater and will remain so for a long time to come. The reason for this is obvious. The Science of Geology has held in the past and still holds, with respect to its other sister Sciences, an unenviable position in India. It has not been fortunate in receiving that share of amateur contribution from men of liberal learning and culture who generally fill the public services of India and who have enriched the records of Indian Natural History, ethnography, botany and archaeology. The cause for this circumstance, as also for what appears to be an inexplicable indifference of the educated people of India towards Geological Science—a people who evolved in the past some of the earliest true conceptions regarding the fundamentals of the Science of the earth—lies perhaps in the very nature of Indian Geology and some of its puzzling singularities. Let us briefly examine these :—

Causes of this isolated position of Geology.

In the early half of the 19th century a number of amateurs belonging to the service of the East India Company or to private Commercial undertakings, with more enthusiasm than geological knowledge, were fired with the desire to prove the great mineral wealth of the Indian Peninsula by

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establishing all sorts of fanciful parallelism between the Indian formations and the economically productive horizons of England and other parts of the world. Their disappointed expectations and the barrenness of such search, combined with the absence of the usual geological land-marks such as one is accustomed to in Western Europe, produced as their result an undeserved aversion towards all kind of geological pursuits in India in the minds of their successors—a set-back from which Indian geology has not yet recovered To the unselfish lover of pure science, in pursuit of purely scientific data, the imperfect and fragmentary nature of the stratified record as preserved in India has caused repulsion in another way. The disconcerting geological antithesis presented by the two natural divisions of India the Indo-gangetic alluvial terra in recording only the latest chapter of geological history ; and the most important areas of the Peninsula lying under the undecipherable records of its earliest chapters,—the two neglected extremes of geological history of those days, detracted all interest and zeal of the seeker after knowledge. The one area by its total lack of geological interest, the other by its seeming simplicity which obscured under an apparent uniformity the most puzzling complexities in the study of rocks. Yet another derogatory circumstance which contributed to produce apathy in the man of science towards geological field work lies in the vast pre-Palaeozoic formations which cover nearly a hundred thousand square miles of the Peninsula. For these there is no parallel in the geological annals of Europe. The unrelieved monotony of these deposits and their barrenness in the accustomed type of organic relics caused them to be abandoned as worthless for stratigraphic purposes, for fossils were then considered to be the only alphabet of geological knowledge and the modern more refined, though less certain, methods of the study of sediments had not come into vogue.

Apathy of the educated people.

While these causes account for the inattention of the man of science and general culture towards geological investigation in India, and tend to prepetute the disparity between the amount of ground covered and that which remains to be gone over, the indifference of the educated classes of the people of India towards geology is also easily accountable. The lack of variety in topographic relief over vast stretches of the country and of rapidly alternating geological features from district, to district, which first arouse curiosity in the minds of the more intelligent among the population and attract them to the scientific study of earth-features, have been sufficient causes to bring about this sterility of knowledge. A weary uniformity and monotony in any group of phenomena, do not furnish the proper medium in which the germs of new know-

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ledge can take birth and thrive; the tendency would rather be to atrophy any curiosity or spirit of inquiry.

Remedy for this isolated position of geology.

But the stride of investigation in other parts of the world and the great progress achieved in every department of geology during the last twenty years, notably in Mineralogy, Petrology, Economic geology, not to speak of the extension of our knowledge in the theoretical aspects of the science, compel the attention of the workers in India to examine into these causes of imperfections which make for our backwardness especially as regards the volume of India's contributions to the geological research of the world. It behoves Indian geologists to search for a remedy and to find out means whereby geological work in this country is made more attractive to the private individual with a taste for scientific pursuits and to recruit in its service a band of amateur workers such as in European countries contribute so largely to swell the volume of field and laboratory investigation; to further areal and regional geology by the exploration of new or unknown tracts; and to supplement generally the efforts of the official surveyors in elucidating whatever new problems arise. Also it will become increasingly necessary and profitable to utilize the university-trained students who have specialised in a post-graduate course after giving them suitable training in field-methods. Hitherto this class has furnished no recruits either to the official corps or, to any material extent, to the body of prospectors, miners, or other professional geologists.

The Great Pre-cambrian formations. Cuddapah and Vindhyan.

It is when this co-operation is forthcoming in some considerable measure that the labours of the official geologists of the Geological Survey of India can be liberated from the stratigraphic and areal survey to which they have to be still largely restricted, for employment in the more specialised branches of the science. The time will then come for organising such special branches of the Survey as have not received consistent systematic attention hitherto such as glacial geology, physiographic geology, the geology of mineral deposits, of water supply, drainage, etc. Other fields of research await the specialist; and among them none is more promising of results than the great pre-cambrian formations of the Peninsula. Till now these great groups of the most ancient sedimentary strata have been given up as hopeless in respect of furnishing any noteworthy data of pre-cambrian geology. Yet in the extreme antiquity of such thick masses of sediments which have undergone scarcely any alteration of their original characters; in their wonderful immunity from structural disturbances, in the organic barrenness of such wide sedimentary tracts which represent the coast-line of the primitive ocean at a period in the

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earth's history when there is so much evidence to suppose the first rudiments of life appeared on the planet, the Cuddapah and Vindhyan formations are unique. These 35,000 ft. of littoral deposits representing the drift of a continent at an epoch of the earth's history designated, by the common consent of geologists as the *proterozoic*, constitute just the portion of the geological record which may reasonably be expected to hold some clue to the mystery regarding the first appearance of life on the earth, an event which must always remain the most important in the history of our planet. The question arises whether the study of these sediments cannot be advanced by a new method of attack, whether the microscope and the recent methods of micropetrology of sediments cannot be applied to discovering some facts connected with the physical history and geography of those by-gone times as well as in discovering some signs or vestiges of organic activity during their deposition. The structural as well as metamorphic changes have been too few in them to have affected the original characters or contents of these rock-bodies and herein lies hope for the inquirer. Interest of another kind is associated with the archaean-Dharwar complex which bristles with problems of a different kind hitherto but partly solved. The views promulgated by the Mysore State Geological Department, based on their very detailed work on a large section of this rock-expanse, about their origin, mutual relations and age have tended to simplify some aspects of these problems, but much research of long duration is still needed before this bewildering complex of sedimentary igneous rock bodies is made to disclose its secrets in the interest of petrogenesis, rock-metamorphism, the genesis of ores, plutonic action and reaction, etc.

The Archaean-Dharawar Complex.

When painstaking research is undertaken by specialists in this direction, these hitherto blank recods are sure to yield data of much interest and importance which may result in some definite contribution to the geology of the world. Far from being therefore, a useless dead-weight in the geological chronicles of the earth, these great pre-cambrian rock-records of India may yet prove to be the more significant part of that chronology, though written in a script other than the common script of palaeontology.

II. The Geological Sciences in their relation to the mass of the people.

But no advance in pure research, however great the results may be in their philosophical aspects, can ever be expected to awaken the minds of the people at large unless at the same time they affect some vital industrial or social side of their life. Indian geo-

Economic Applications of Geology.

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logy is likely therefore to remain in the position of obscurity in which we find it to-day with respect to the generality of the people, until conspicuous developments take place in the economic applications of this science to the industries and agriculture of the country. From this point of view the inattention that is very general towards any application of geological knowledge in aid of agriculture and the development of the 300,000,000 acres of its surface forms a striking feature. This is a regrettable fact, for it can be asserted without exaggeration that the cultivation of agricultural geology in India on the lines adopted by some of the States of the United States of America would be likely to bring as rich a harvest of results as the more popular and better-esteemed pursuit of mining geology. For the wide alluvial plains of the Indus and Ganges, which cover more than 400,000 sq. miles, and which doubtless comprise many minor variations in soil both in respect of physical structure as well as of chemical and mineralogical characters, a well-organised Soil-Survey supplying authentic information on the above heads would be sure to improve agricultural practice and economics. A systematic Soil and Subsoil survey; the investigation into the condition of the water-table in different districts and a survey of Artesian water supply in the dry alluvial tracts and along the desert-borders; experiments on the extent of usefulness of mineral fertilisers in combating the increasing impoverishment of the soil of Madras and the Central Provinces; are some of the measures in which the co-operation of the geologist with officers of the Agricultural Department is necessary. Irrigation by canals in the Punjab has already materially affected, and is likely to do so in still greater degree in future, the under-ground drainage and water-level, and has thus introduced a problem of serious import to agriculturalists. In battling with this menace, for a study of subsoil geology and experiments relating to subsoil permeability and rate of water percolation, the co-operation of the geologist may be sought with profit.

Agricultural Geology.

After nearly a century of struggle with adverse conditions, mining activity in India seems to be nearing the dawn of a new and more prosperous epoch. There are signs that it is soon going to emerge from its one sided activity of coal mining to which it has been hitherto, to a large extent, restricted by a combination of adverse circumstances, to enter into a new field of metallic mining. The discovery of large stores of metallic wealth in Singhbhum, coupled with the existence, on a sufficient scale and within practicable radious, of the subsidiary raw mineral products required in supplying the principal metallurgical needs of India, puts the mining and metallurgical industry on a favourable basis, for the first time in its history; and the

Mining industry in India: improving prospects.

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coming decade may be expected to witness important revolutions in the annual output of iron and steel, manganese, copper, load, zinc and possibly other metals.

Ignorance of the small mine owner.

But the small mine-owner in India as a class has not yet come to appreciate to any degree the intimate relation between geological conditions and the occurrence of ore-bodies and other useful mineral deposits. To that extent therefore, private economic surveys (with the exception of the few great undertakings) are scarce and haphazard. In the absence of special surveys of private properties, all the information that is considered necessary in the commercial exploitation of a deposit is sought from the publications of the Geological Survey on the districts in question, in which the survey of economic mineral deposits was not special but only incidental, and was never intended for such use by private mining associations. One is not surprised therefore that as consequences of such practice, the occupation of mining in India has remained as yet in that indefinite speculative stage from which other countries are emerging, and that the methods of mining pursued in many cases, even in regard to some of the most important deposits, have been pronounced to be primitive and ruinous to the properties.

The need of mining and technical experts; industrial geologists.

The country needs a body of expert industrial geologists in the present stage of its mineral development. They are needed to expand the resources in coal by the exploration of fresh areas and by the deeper mining of existing fields to investigate still untapped oil areas and to prospect for new ones; to improve the existing methods of mining of manganese, iron and other metalliferous ores; and to exploit the rich resources in the metal aluminium possessed by several parts of India. Large regions within the Himalayas have not been visited by the prospector and there are likewise many areas within the Peninsula where the apparently small or less promising mineral deposits have not yet been thoroughly investigated and reported on by experts. But above all there is a demand for mining and technical experts to solve the problem of our hitherto neglected sulphidic ores, to find avenues for their profitable employment in the metallurgy of their respective metals as well as in the host of chemical manufactures which nowadays form an accompaniment of these metallurgical processes.

It is hardly necessary to point out the economic benefits of private mineral surveys of properties conducted by the landowners and ruling states, especially by the smaller Indian states. Besides being of direct utility in matters relating to prospecting and mining of minerals, competent geological advice will prove beneficial in many hydrographic and engineering

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problems, afforestation, etc. A very desirable incidental result which may be expected to accrue from a multiplication of such surveys in different parts of India, is the probability of an increased number of trial bores being put down for prospecting purposes. Though many of these may not achieve the specific purpose for which they were undertaken, their boring-records and charts may ultimately be of great service in supplying valuable information for other purposes. There is perhaps no country in the world, where area for area, there have been so few deep borings and drill-holes penetrating the water table as India. By so much therefore the country is poor in data of underground conditions, from which a considerable body of facts affecting adjacent parts are deduced with sometimes very valuable economic results.

III. Geological and Mining Education in India.

Neglect of Geological Education in Schools and Colleges.

The educational facilities existing in India for the training of young men in geological sciences both for the purely cultural benefits of the science as well as for its pursuit as a vocation in life were, until almost yesterday, of the most meagre description. If we exclude the projected Dhanbad school of Geology and Mining which is under organisation by the Government of India and the Geology department which is being organised, at the Benares Hindu University, there is only one Geology school in the whole of North of India between Calcutta and the North-West Frontier and that is in the Kashmir State (Jammu). There are only four other places where Geology is taught besides one Mining school attached to the Sibpur Engineering College which trains students for Sub-Overseer's work in the Coal mines of Bengal, Bihar and Orissa. The education imparted in the former set of institutions in Geology, being limited by the scope of the degree-examination in Arts and Science; suffers perhaps from all those drawbacks which are so often alleged against science teaching in our Universities. But even admitting these draw-backs one would wish to see more adequate provision made for geological instruction in all our Universities, instead of their present policy of suffering individual colleges to grapple with their own difficulties and do as much or as little as they want in maintaining their geology teaching. A great opportunity has arisen for organising the teaching of this science as a University subject on sound lines in the new Universities that are coming into existence in different parts of India. In doing so they will supply one important *desideratum* in the present needs of the country. Those that have a hand in the management of science education in our schools and colleges have neglected an

Neglect of an Educational Asset.

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educational asset of high efficiency in their neglect of this branch of Nature-study as a subject of liberal education and culture. The mention of geology too often calls forth visions of the discovering and mining of precious stones and metals, an end which can only be fulfilled by a training in England, Japan and America, the knowledge of the geology of India being considered not at all requisite to this end. This narrow interpretation of the objects of Geology has much to do with the indifference of many educated persons towards the cultural aspects of this science and its many other technical applications, no less important than Mining, viz. Geological surveying, Agricultural, Forest and Engineering Geology, the Geology of Water Supply and of Economic Mineral deposits other than metals. Thirty years ago when suitable literature for school and college use was scanty and men versed in this science were few there existed an excuse for the non-recognition of Geology as a subject for instruction in our Universities. Both these difficulties have in a great measure, disappeared, or are fast disappearing.

Technical Education in Geology; the Dhanbad School.

The problem of technical education in Geology and Mineralogy no longer remains in the same unsatisfactory state, for it has lately received a most fortunate solution at the hands of competent authorities. The institution of the Dhanbad school with its contemplated scope and scale of equipment, which when completed will, it is hoped, enable the institution to rank with similar institutions in Great Britain, will meet the complete needs of Mining and Geological education in India for several years to come. It will now remain for the public to appreciate widely its benefits and take advantage of the newly created facilities, which will provide a fresh avenue for the vocational training of youths.

Condition of the Geology Section of some Museums.

I make use of this opportunity, to touch with regret, upon a subject which has an important bearing on the spread of elementary geological knowledge in this country and upon its being brought home in a popular way to the general public. This is the pitiable condition of the Geological sections of many Provincial Museums, which suffer from complete inattention if not neglect. In the first place the collections that are exhibited under very inviting head-names of "Mineral Gallery," "Geological Section," etc., are of most inadequate and indifferent material. In many cases no effort is made to obtain competent help or advice in their assembling or in their correct naming, arrangement or labelling. I have seen Black trap under titles of "Coal" and "Manganese-ore" in more than one place. A competent geologist and prospector who has spent many years in India, himself a good collector, once said in the matter, "It makes me cry to visit Indian Mineral

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Museums. Think for example of the ones at ..... and at ..... ; it is the result of letting the peons "Spring-clean" the collections and sprinkle the labels back afterwards. I have seen lovely Black trap labelled coal, and crystalline rocks labelled with place-names recalling alluvial sand. After this has happened a collection is no better than road-metal." Not only are the collections indifferent, but there are no charts or maps depicting the chief geological features of the province or of its—principal mineral occurrences. Excellent material of this description is furnished by the Memoirs and Records of the Geological Survey or can be easily compiled from them.

In a country where Museums are so few and geological museums fewer, this neglect of opportunity to interest the populace in things relating to the mineral kingdom is most regrettable. It is also unaccountable when one sees so much attention and scientific care devoted to the assembling and upkeep of sections relating to Natural History.

Reprints of out-of-date Memoirs and Records.

While dealing with the subject of geological education I venture to make one or two suggestions to the Geological Survey Department which have a bearing on it. All that have to do with the study of Indian geological literature have keenly felt the need for reprints of the large number of Memoirs and Records, published mostly anterior to 1890, which are now out-of-print, and have been so for many years. These are non-procurable on sale or on loan and amongst them there are several valuable monographs and district contributions on the geology of important districts and sections of provinces. So long as these gaps exist the material for the literature of Indian geology cannot be said to be complete; for the unofficial worker, who anywhere outside Calcutta is thus deprived of nearly one-third of the total number of Records and Memoirs published, or perhaps succeeds in finding them locked up in the shelves of one or two libraries in the country. The reprinting of these journals, with their original plates and illustrations, has now became a matter of public utility as their absence will be more and more widely felt by an increasing number of students, teachers, industrialists and the intelligent citizen generally. Another *desideratum* from the same point of view, which I submit for the consideration of the authorities, is the compilation of complete provincial, and in some cases even district Geologies, the compilation being brought up to date by incorporating all the later work, mineral statistics, etc., and provided with large scale-maps depicting geological as well as economical features of the district or province in question.

Geological maps on enlarged scale.

Among the parts of India which specially call for such revised publications (or *reprints* as the case might be) should be mentioned: Cutch, Sind, Assam, Hazara, Gujarat, Nagpore, Singh-

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bhum, Kashmir, N.W. Punjab, Central India, etc.. With the expansion of industries and the awakening of popular interest in natural resources these publications would be more and more sought after for accurate and authoritative information. A revised edition, on a still more enlarged scale, of the 1910 –edition of the Geological Map of India (1″ = 32 miles scale) possessing a greater degree of cartographic detail will also fill a standing want.

IV. The Outlook, Conditions for Development of Geological Science in India.

Re-organisation of Geological Survey.

After this brief survey of the condition of geological research in India one feels justified in entertaining the belief that material progress can only be expected in the present position of the science when two conditions are realised in the near future. One of these conditions is that the Geological Survey is reinforced, its cadre being multiplied to double its present strength and that it is adequately organised in every branch. The Resolution of the Government of India in this connection, lately published, announcing the re-organisation of the Survey makes a most welcome beginning and leads one to hope that it will be followed by similar schemes in the future. By such liberal measures of expansion alone can the Survey be enabled to cope with the steadily widening field of operations, scientific and technical, which nowadays come within the purview of a Government Geological Survey.

Future Institution of Provincial Surveys.

We can then hope for the institution of some Provincial Surveys conducted under the direction of one central Imperial Survey. An excellent example of what a provincial survey working within its own borders can achieve in the direction of detailed surveying of a complicated region is furnished by the Mysore State Geological Department. The increased volume of literature which the Geological Survey of India in its then state of organisation will publish will have a more direct bearing on many of the immediate public needs and questions. Interest will be awakened in questions concerning water resources and drainage, mineral occurrences, agricultural and mining topics by monographs, bulletins and professional papers of a popular description besides the purely scientific and technical official publications. The compiling of provincial and in some cases district geology, written in a popular manner for the man of industry and for the school and college student, illustrated by large-scale maps will do much to popularise the science and elevate it from its present obscure condition, at the same time securing the good-will and co-operation of the people in the field-work of the Survey Officers.

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One other incidental gain will accrue. An enlarged force of workers in the Geological Survey will bring the operations of that Department into more intimate relations with the public and thus tend to spread more correct ideas about the movement and operations of field geologists in regard to which the haziest notions prevail now. In the interest of the Science as well it is expedient to interest the public in the work of the field geologist. On this matter Hayes, Chief Geologist of the United States Survey says, "It is generally advisable to take the necessary time and trouble to explain to any-one making serious inquiry exactly what is the object of the work. This is of course essential when the Survey is official and carried on at Government expense. The oppurtunity of educating the people of a region in which work is being done to an appreciation of the nature and importance of Geological Surveys should be utilised as far as possible."

Theoretical Education in Geology.

The other of the two conditions relates to the creating of proper facilities for a sound theoretical teaching of geology. In this connection the public mind should be disabused of the common prevailing idea that in a science like geology all that is needed in the way of educational equipment of the youths is training in some Mining school and that training in pure geology is of secondary importance to the students as well as to the country at large. This is a wrong notion. No science can progress if its cultivation is restricted to its technical side only. Without a firm and wide substratum of education in the pure science, all efforts towards the development of geological knowledge in the country will be hollow and spurious; it would be to degrade science from its high pedestal to the position of a handicraft. The right procedure is to begin at once creating the proper atmosphere by establishing a number of centres where geology is taught as a science for the sake of its liberal education and culture. The object will be best realised if two or three of the first grade colleges in each Presidency were to offer an under-graduate course of geology just as they do courses in biology, physics and chemistry with provision of means for further post-graduate study and research at one or two centres.

The Dhanbad and Jamshedpur Schools.

At the same time it is essential that the country should be self-sufficient in the means for a complete course of technical education in all departments of geology, side by side with the provision of academic education. Happily, owing to Government's action in this matter we are at the threshold of important developments. The Dhanbad school of mining and geology, founded at the very centre of India's mining industry, and the foreshadowed institute of metallurgy at Sakchi-Jamshedpur, equally fortunate in the site of its

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location, and of like scope and equipment, will make ample provision for the needs of the country in this respect for the present and for several years to come. These two institutes may be relied upon to provide adequately trained young men for the vocation of surveying, prospecting, mining, metallurgy and other related occupations such as India has already begun to demand.

Gentlemen, I do not feel warranted in trespassing upon your courtesy further.

The manufacture of china and porcelain in India.—*By* K. A. KNIGHT HALLOWES.

This paper gives a description of the most modern process for the manufacture of china and porcelain from washed Indian china clay.

After a rational analysis has been made of the washed clay, it is mixed with the right proportions of powdered calcined orthoclase and quartz to produce the kind of china or porcelain required, and is then ground up in "ball-crushers" to an impalpable powder which is stirred with water in a "blunger" to thorough homogeneity. This is piped off into a trough known as "the agitator," from which it is drawn by a membrane pump to supply "the filter-press", being afterwards transferred to the "kneading mill" which produces clay of uniform plasticity.

It is then shaped on a potters wheel, or, after admixture with the right proportion of water, poured into moulds made of gypsum which readily absorbs the large amount of contained moisture.

The articles, after air-drying, are then placed in "saggars," and heated by waste gases in the biscuit chamber of a Dresden kiln to a temperature varying from 700°–800°C.

When quite cold they are dipped by hand into a trough of glaze composed of a finely powdered mixture of kaolin, orthoclase, limestone, and quartz.

Finally, the glazed articles are again placed in fire clay "saggars," and fired for twenty four hours in a round down-draft Dresden kiln, at a temperature of 1350°–1400°C. They are kept in this an additional twenty-four hours at a slowly decreasing temperature for annealing.

As great care is exercised in this process it is found that the breakages do not amount to more than 5 per cent.

On a new fossil unionid from the intertrappean beds of Peninsular India.—*By* B. PRASHAD.

In this paper the author describes a new fossil Unionid from the collections of the Geological Survey of India. The fossil had previously been identified as Cyrenid and labelled *Pisidium medlicottianum*, Hislop; with which, however, it has no relationship, being a true Unionid belonging to be genus *Lamellidens*, Simpson, a full description of this species, which is called *L. vredenburgi*, is given, and its relationships with the other living species of the genus is discussed.

Unionidae from the Miocene of Burma.—*By* E. VREDENBURG *and* B. PRASHAD.

The only fossil Unionidae hitherto known from India were the imperfectly described ones from Sub-himalayan Siwaliks recorded by Torhes, the fossils from the Intertrappean beds of Uppermost Cretaceous age in Peninsular India and those from the lower Bugti Beds of Baluchistan. It is, therefore, of special interest to be able to describe some specially well preserved fossils from the Uppermost Miocene beds of Burma. Two

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new species are described under the name *Indonaia glyptica* and *Parreysia Latouchei* and their relationships with the living representatives of these genera are fully discussed.

A stem-impression from the plant-bearing beds near Khunmu (Kashmir), provisionally referred to *Gangamopteris kashmirensis*, Seward.—*By* B. Sahni.

While the attribution of the frond-genus *Glossopteris* to the peculiar rhizome-like organ *Vertebraria* has now been established, we are still in ignorance of the stem that bore fronds of the closely related *Gangamopteris* type. During a recent visit to the well-known *Gangamopteris*, Beds, near Khunmu in Kashmir (Risin Spur, 1½ miles S.W. of Guryul Ravine), the author collected the impression of a branched axis preserved in circumstances which suggest that it may be the stem of *Gangamopteris kashmirensis*, Sew. Closely associated on the same rock-surface are also portions of *Gangamopteris* fronds possibly belonging to the stem, but not now in organic contact with it. The only other recognizable fossil plants from this locality are *Psygmophyllum* sp. (probably *P. Haydeni*), Sew.) and *Cordaites Hislopi* (Bunb.), and there is no indication that the stem in question belongs to either of these species. The stem cannot be confused with *Vertebraria*, for it shows none of the features characteristic of that genus. Moreover, although since the discovery of plant-remains in these beds several distinguished workers have collected in this locality (Noetling, Hayden, Middlemiss,) no specimens of either *Glossopteris* or *Vertebrata* have come to light, while *Gangamopteris* fronds occur in large numbers.

The stem is unfortunately in a poor state of preservation, about 20 cm. long and 1 cm. thick. In two places short thin branches (? roots) are seen coming off.

Palagonite-bearing Dolerite from Nagpur: suggestion regarding the nature of Palagonite.—*By* D. N. Wadia.

"Palagonite" is found in a coarse orthoclase-bearing dolerite filling up large and numerous lacunae forming nearly 10 per cent of the bulk of the rock. The lacunae are from $\frac{1}{4}''$–$\frac{3}{4}''$ long and $\frac{1}{8}''$–$\frac{1}{2}''$ broad; they branch and spread in all directions and send irregular blunt ramifications through the mass of the rock. They are stopped by an amorphous black, brittle, much fissured, glassy-looking isotropic substance; orange or green in thin flakes, with a typical conchoidal fracture and resinous to vitreous lustre. No colour changes were observed on exposure to the air or light; infusible B.B.; yielding much water, both hygroscopic as well as combined.

The black colour is not intrinsic, but is due to an external coat of iron; it is easily removed by acids, leaving a colourless transluscent glass (silicate of alumina and some lime and magnesia) as residue and yielding strong ferric solutions. S.G.=1·6; H.=2-2·5; r.i.=1·50.

In micro-sections the palagonite occurs both as a zeolitic infiltration product showing concentric rings of growth and as irregular alteration patches among and around augite and magnetite crystals ultimately replacing them. The felspars are quite unaffected and remain clear and glassy. There are a few biotite crystals. There is no olivine or any ground mass.

A study of the lacunae suggests that they are not of the nature of original vesicular cavities but are of secondary creation due to processes resulting in the formation of palagonite. With regard to the origin and nature of the latter the following suggestions are advanced:—

(1) that it is not a definite mineral but an amorphous, structureless decomposition product;

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(2) that it is not due to replacement of the original glass of the rock;
(3) that it is a decomposition product of the magnetite and augite of basic rocks;
(4) that while in some cases it fills up cavities like zeolites, in others the cavities are secondary spreading lacunae stoped out of the rock by the decomposition of some of its constituents.

Asbestos of Saraikela.—*By* S. C. Dutta.

The author discusses the method of formation of the asbestos veins of Bana in the district of Singbum.

The clays of Lametaghat.—*By* K. K. Sen Gupta

In this paper the author gives his reason for thinking that some of the clays in the Lametaghat which have hitherto been included under the Jubbalpore group do really belong to the Bijawar system. The physical and chemical properties of this Bijawar clay as also its economic possibilities are discussed.

Cryptozoon in the pre-cambrian strata of India.—*By* E. Vredenburg.

Specimens obtained some years ago by Mr. F. H. Smith, of the Geological Survey of India, from some limestones of apparently Kadapah age in the neighbourhood of Raipur, have been identified as referable to the genus Cryptzoon which is known to have flourished in North America and Australia from pre-cambrian to lower ordovician times, and is the oldest undoubtedly organic genus at present known. The Raipur specimens resemble the Australian species, *C. tessellatum.* The same genus is probably represented in India also in the Gwalior series of Central India and in the Kadapah series of the Cudapah district.

A short note on the Trichinopoly boulder-beds.—*By* H. C. Das-Gupta.

In this paper the author describes the phosphatic nodules occurring in the neighbourhood of Utatur. Microscopic sections of the nodules show the presence foraminifera in them which evidently are of Utatur age. Attention is drawn to the palaeogeographical significance of the distribution of these nodules and suggestion is made that plant remains may have played a part in the production of Ammonium Phosphate necessary for the pseudomorphic change of Calcium Carbonate to Calcium Phosphate.

The discovery of the neolithic Indian script.—*By* H. C. Das-Gupta.

In this paper the author discusses the evidences on which the existence of a neolithic script in India has been based and gives his reasons for thinking that the existence of a neolithic script in India has not been established and more conclusive evidences are necessary to prove the case.

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Section of Medical Research.

President :—Lieut.-Colonel J. W. D. Megaw, B.A., M.B, I.M.S.

Presidential Address.

Let me begin by expressing my thanks to those who have honoured me by asking me to preside over the Medical Research Section of the Indian Science Congress. You may also expect me to apologize for occupying the presidential chair, but it seems to me that whatever apology is required should come from those who have selected me rather than from myself.

It is true that when the invitation to preside reached me my first impulse was to refuse. It seemed to me that the position should be filled by someone who has spent his life in the work of medical research rather than by one like myself who has done comparatively little research and that as a side issue.

On further consideration it struck me that possibly my selection may have been made with the deliberate intention of emphasizing the many-sided nature of medical research and the close connection that it ought to have with general medical work. It was this second thought that induced me to welcome the opportunity of expressing my views on the subject and in doing so my aim will be to realise the standpoint not only of those who are specially engaged in research but also of the medical profession as a whole and most important of all, that of the general public of India, for they are the people most affected in the long run.

In considering the subject of medical research in India the logical procedure would be to deal with its past history, its present condition and its future prospects.

You will doubtless be relieved to hear that it is not my intention to subject you to such a discourse. There is no need to dwell on the past achievements of medical research to an audience such as this. The great advances that have been made in India in our knowledge of disease is due chiefly to the devoted work of men like Sir Ronald Ross and Sir Leonard Rogers who have shown what can be done by medical research workers under the most adverse conditions. They have not only done work of the greatest value but they have also insistently striven to arouse both the government and the people of India to a sense of the tremendous results that would follow from an adequate exploitation of the discoveries made by themselves and by other workers in the field of medical research.

The present position of Medical Research in India is very much more favourable than could have been hoped for a few years ago. Looking at the state of affairs in Bengal alone

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we find that the unremitting labour of Sir Leonard Rogers during the past ten years has raised a monument to him in the form of the School of Tropical Medicine and Hygiene and the Carmichael Hospital. The difficulties and obstacles that he encountered would have daunted any other man, but to Sir Leonard they only acted as incentives to further efforts and more ambitious designs. In addition to the research workers headed by Sir Leonard there have been many enthusiastic advocates of the cause of medical research in India. The late Sir Pardey Lukis and the present and past heads of the medical services of India and Bengal have been unremitting in their efforts.

It would take too long to mention the professional helpers of medical research in India but there is one name which must be mentioned, that of Sir Kailash Chandra Bose who has done so much for the School of Tropical Medicine and Hygiene in Calcutta.

Apart from medical men there is a large number of officials from the Viceroy downwards and of non officials too who have generously contributed both in money and influence to the cause of research in India. The press must not be forgotten, it has always been to the fore in arousing public interest in the subject.

To all these the country owes a deep debt of gratitude and those who are engaged in medical research must fully realise that the special opportunities which they enjoy involve correspondingly great responsibilities. They must feel that it is up to them to show that the work they produce is commensurate with the encouragement they have received.

When we think of the large number of powerful and influential advocates of medical research we may be tempted to think that all is well with it, but there is another side to the picture and I regret to say that there is still much to be done before we can say to our supporters that their efforts have attained to complete success and that there is nothing to be done but to allow the workers to carry on. Sir Leonard Rogers and other research workers have already stated their views on this subject in the most vigorous terms. I will not attempt to employ the weapons that are wielded with such force and effect by Sir Leonard, to do so would serve no useful purpose and would only expose me to well-deserved ridicule. At a later stage of this address I will lay before you a proposal which may lead to the desired result without laying research workers open to the charge of grinding their own axe.

There is no more important aspect of research work than the workers themselves These may be grouped in the following classes:—

I. The highest type of research worker to which belong men like Ross and Rogers. We cannot count on men like

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these in any scheme for the promotion of research. Both Ross and Rogers have insisted on the necessity for providing opportunites for workers and they have quite naturally suggested that they themselves could have produced more work and better work if they had been given greater facilities. While fully accepting their contention that the research worker must have a favourable environment there is a lurking suspicion in my own mind that men of their type sometimes do better work when they encounter difficulties and opposition than they would if they were pampered and encouraged.

It does not matter if there be any truth in this idea, men of the type referred to, unfortunately are so rare that there is no need to legislate for them. When they do occur they are seldom amenable to the rules that apply to ordinary men and they will not fit in with any ready-made scheme that may be prepared. All that we can do is to be thankful that they do sometimes crop up.

II. There is next the highly skilled expert worker. His services can readily be obtained if we are prepared to pay the price for him and to provide him with facilities for his work. Experts are essential to the success of any scheme and if you want to know the conditions that are necessary for securing a supply of such men you have only to ask Sir R. N. Mukerji or Sir J. D. Tata or the head of any large commercial undertaking. You will be told that for important work it pays to engage only the best men and to give them really attractive conditions of service. It is to the skilled research worker that we must look for the solution of the more difficult and complex problems of medical research. To secure his services and to get the best work out of him is simply a question of organisation such as is encountered every day by a large industrial concern.

III. The third group comprises the rest of the medical profession, these might be subdivided into an indefinite number of types, but for the sake of simplicity they may be classed together. In the past a great deal of valuable work has been done by them, but they have suffered from a number of drawbacks. They have lacked the help and guidance that are needed, they have been isolated and so have had no opportunity of co-ordinating their research with that of other workers on the same lines. There are great possibilities in the organisation and encouragement of those medical men who are interested in research, they are capable of turning out a great deal of valuable work and they will at the same time supply recruits to the ranks of the special research workers. The courses of instruction which will shortly be started in the School of Tropical Medicine and Hygiene in Calcutta will serve the double purpose of greatly increasing the efficiency of the

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medical men who attend and of educating them in the technical methods of research.

The next aspect of the subject to be considered is the organisation of research. It is essential that there should be a definite and carefully worked out plan. When every worker is left his own devices there will be inevitable waste of time and energy. A great deal has already been done in India in connection with the organisation of special research work, but much remains to be done, and we should not be satisfied until a smoothly working concern has been established on the best possible lines.

At the same time there must be no attempt to dragoon or Prussianize research. Each worker must be free to express his own views without restraint, even if his opinions do not agree with those of the men who are directing him. There must be no cliques under the domination of a leader who is in a position to dictate to his workers.

Every one who is employed in a research institute must have a reasonable amount of leisure at his disposal just as the teachers in the great universities have and it must be understood that credit will be given not only for the work that is carried out under control but also for the independent work that may be done. In this way it will be possible to combine the benefits of directed organisation and of untramelled research, or in other words there will be team work without converting the members of the team into hacks.

There should be an immediate stock taking of the existing position of organised medical research to make sure that it has not already become surrounded by conventions or hampered by the paralysing influence of established custom. Research work is likely to expand so rapidly in the near future that it is essential that it should progress on well-considered lines and that arrangements should be made for a periodical review of the whole subject.

In connection with the organisation of research we are struck at the very outset by the fact that we have no accurate knowledge of the distribution of many of the fatal diseases of India. The incidence of cholera and small pox is fairly well known because these diseases are so striking that even the village chowkidar is not likely to make a mistake about them. But in the case of malaria, kala azar, hookworm disease, leprosy, tuberculosis, and many of the most important preventible diseases we have only a vague and inaccurate knowledge of their distribution. So that in the campaign against disease we are lacking in the first essential which is accurate information of the strength and disposition of the enemy.

A systematic survey of the diseases of India is an obvious necessity that can be provided for very easily and at a small cost. For most of the districts of India a motor or

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bullock caravan would be suitable ; the personnel and equipment should be such that at each place visited there would be: (1) advance advertising by attractive posters and otherwise ; (2) popular cinematograph lectures, free provision of medical aid and the distribution of leaflets ; (3) when the confidence of the people has been gained and their interest aroused a detailed enquiry into the diseases prevailing in a definite area would be made.

If there were a census caravan for each district it would soon be possible to arrive at a knowledge of the state of affairs in a large number of sample areas all over India and so to prepare a survey of the diseases of the whole country. This would gradually become more and more complete and in a short time we should have an accurate map which would show in a graphic manner the distribution of the more important diseases. A map like this will be invaluable when it becomes possible to arrange for a systematic campaign against the preventible diseases of India.

In the United Provinces a survey of the distribution of hookworm disease was carried out recently under the direction of a small committee appointed by Government. The result is that the incidence of that disease in the province is known with some degree of accuracy. Thanks to the suggestion of the president of the committee, Col. Mactaggart, I.M.S., the survey was followed up by a course of instruction to the medical men of the province at selected centres. This in itself more than justified the small expenditure incurred in connection with the enquiry.

Another line of research that could be organised very easily is the collection of information from the case records made in the medical schools and colleges. Many thousands of these records are made every year, but hardly any use has been made of them for the purpose of adding to our knowledge of disease in India. If these records were kept in the tabular form which was so successfully employed by Sir Leonard Rogers in his investigations, the work of the students and teachers would be greatly improved and a vast amount of useful information would soon be accumulated in a form which would allow of its being analysed at a central bureau. All that is needed is a supply of blank forms for each disease ; these would be ruled in columns with suitable headings for the points regarding which information is required, and there would be a set of conventional signs by which the details could be recorded briefly and rapidly. The same kind of machinery could be employed for the collection of information regarding any new question that may crop up in connection with one of the diseases of India. The scheme need not be confined to the teaching hospitals, it could be extended to every medical man who is prepared to help. This method of collecting infor-

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mation is not at all likely to hamper initiative, its tendency would rather be to suggest fresh lines of enquiry and to stimulate the interest of those who are engaged in it.

An aspect of medical research that is well worth attention is the maintenance of a just proportion between laboratory work and the observation of disease in human beings. Laboratory work has many advantages, it is precise and easy of control, it is usually carried on by experts who have specialised in their own subject, it is something of a novelty and it has an extraordinary record of brilliant successes. Observation of disease in human beings on the other hand is usually obscured by disturbing factors, experiment and control are seldom possible and the observers as a rule are general practitioners who are more interested in the welfare of their patients than in the promotion of science. For these reasons it is not surprising that the work done with the microscope, the test tube, and experimental animals has overshadowed that done by clinical workers and general practitioners. In spite of the triumphs of bacteriological work it must be insisted on that the final and crucial test in connection with any disease is not what is seen under the microscope or in experimental animals, but what happens to human beings who suffer from it. Let us look at some concrete examples which illustrate this point. There are many research institutes devoted entirely to the study of cancer, in these the best available experts have been employing every means at the disposal of the laboratory worker. In spite of the labour of so many workers for such a long time our knowledge of cancer from a practical point of view has been very slightly increased. It seems likely that if attention were concentrated on the disease as it occurs in India and Kashmir we might soon obtain definite knowledge which would enable us to prevent a large proportion of the cases of the disease.

The epithelioma that affects thousands of Kashmiris at the very spot where the *Kangri* comes in contact with their skin is obviously associated with chronic irritation. So is the cancer of the mouth which is so common in India and which affects the very spot where the plug of betel is kept. Then there is the interesting observation from China that the males who eat their rice piping hot suffer frequently from cancer of the stomach while the females who eat the cold leavings of their husbands' meal hardly ever suffer.

For several years I have been struck by the relative rarity of cancer of the stomach in India as compared with Europe, and the only explanation that appears to be plausible is that in cold climates the people are in the habit of drinking hot liquids while in India the tendency is to take cool drinks. If this suggestion proves to be well founded it follows that hot tea is responsible for many deaths. Far be it from me to say a word which will add to the trials of the much suffering tea

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industry, so let me hasten to add that it is the temperature of the drink that matters and not the fact that the drink is tea. Any other hot liquid would produce exactly the same effect. Weak tea if taken at a reasonable temperature is a drink which is worthy of the unqualified advocacy of the medical profession; it is almost the only safe and attractive drink that is widely used in tropical countries.

There are many other examples of the association that exists between chronic irritation and cancer, such as clay pipe smokers' cancer, chimney sweeps' cancer and X Ray workers' cancer, and altogether it seems likely that a close study of the conditions under which the disease occurs in human beings all over the world may lead more rapidly to a knowledge of how to avoid it than all the expensive research that is being carried on in England, France, Germany, America, Japan and other countries.

A disease of special importance in India is Beri Beri under which name it is convenient to include Epidemic Dropsy as no one has brought forward convincing evidence of the distinction between the two diseases. Medical scientists have accepted the vitamine deficiency theory of the disease with wonderful unanimity. Let us briefly examine the evidence on which this theory is based. It has been proved that by feeding fowls on polished rice for some time they become affected by a degeneration of the nerves which is known as polyneuritis gallinarum. This disease is readily cured by feeding the fowls on the polishings of the rice or on extracts of these polishings, and it is quite obvious that the disease is due to a deficiency in the diet. Now polyneuritis gallinarum shows some points of striking resemblance to beri beri and as the latter disease in the great majority of cases occurs among people who eat polished rice it is not surprising that the chain of evidence should have been regarded as complete, in fact to doubt the food deficiency theory of beri beri is usually regarded as rank heresy. But there are some facts in connection with beri beri which cannot readily be explained by the deficiency theory, for example the great outbreak of the disease that occurred in Calcutta and other places in India about eleven years ago. This occurred in epidemic form among people whose diet remained much the same as it always had been and many of the victims were well-to-do people who lived on a varied and nutritious diet which could hardly have been deficient in vitamines. It was also strange that the prisoners in the Presidency Jail who lived to a greater extent on Rangoon rice than most of the victims should have escaped the disease. At the time it seemed to me to be very likely that the custom of mixing lime with the rice stored in the jail and of spreading it out in the sun at frequent intervals was the reason for this immunity. Then the sudden onset of the disease and the gastro-

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intestinal symptoms which frequently usher it in are much more suggestive of an intoxication than of a food deficiency. Quite recently a small outbreak of the disease came under my personal observation. A large well-to-do family was severely affected while the rest of the population of the place did not suffer at all. The diet was varied and nutritious. The symptoms strongly suggested an intoxication and my colleague Major Lister who was asked to examine the eyes of some of the victims whose sight was affected, found that they were suffering from a haemorrahagic retinitis which he quite independently regarded as being toxic in origin. A very striking fact was that one of the family who had been living at a distance came to visit his sick relatives and within about a week of his arrival he began to show definite symptoms of the disease. In his case the deficiency theory could be almost absolutely excluded. Only the other day Sir Koilash Chandra Bose told me of a case which he had once seen in which symptoms appeared within two days of the patient's arrival in the affected area. The observations of Lt.-Col. Sprauson and others in Mesopotamia also strongly suggest that the vitamine theory does not supply a complete explanation.

There are two possible ways of accounting for the difficulty of fitting in all the cases of beri beri with the accepted views as to its causation. The one is that there are really two or more distinct forms of disease included under the name beri beri, and the other is that the disease in fowls, though in some respects similar to beri beri may be a different disease.

I personally incline more to the latter explanation though I quite agree that there may be many varieties of beri beri, and that deficiency in diet is an important factor in same cases, but whichever of the explanations be accepted the fact remains that we have no assurance that we are in a position to prevent or to deal with an outbreak of the disease.

One suggestion that I would make is that possibly we have been relying too much on laboratory findings and not paying enough attention to the disease as it occurs among human beings. Another is that as the disease may break out with great severity at any time it is of extreme importance that there should be a thorough reconsideration of the whole subject.

For the enquiry into the nature of the disease to be a success we must put away all preconceived ideas on the subject and we must collect evidence from every possible source. It is quite likely, for example, that the biochemists may be able to help, they have been carrying out some very interesting work on polished rice from an economic point of view, and it is quite possible that their results may throw light on the beri beri problem. Then the rice manufacturers and merchants should be consulted as there is good reason to think that not only methods

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of manufacture but also conditions of storage of the rice may be factors of importance.

Diabetes is another disease of great importance in India, and a great deal of valuable and highly skilled laboratory work has been done in connection with it, especially in Calcutta by Lt.-Col. McCay and his assistants. There is plenty of *prima facie* evidence that the common form of the disease is very frequent among those who eat too much carbohydrate and who take too little exercise, while on the other hand those who eat sparingly of carbohydrate and who take plenty of exercise rarely suffer. This indication should be closely followed up, and it is quite likely that a detailed enquiry into the habits of those classes that are most affected and of those that are least affected may not only solve the problem of diabetes in India but also convince the people most interested that the solution has been reached. At present the position is that most doctors preach the doctrine of sparing diet and plenty of exercise, but they do so to unwilling ears.

It would almost seem as if the solution of the diabetes problem that is suggested is too simple to be acceptable, or perhaps it is that its practical application entails a considerable change in the habits of persons most affected. In any case there can be no difference of opinion as to the gravity of the disease and as to the desirability of finding out the exact conditions under which it occurs.

There is another disease which is of the greatest importance to the well-to-do people of India, infantile cirrhosis of the liver, it is quite likely that the secret of this disease also may be discovered by an accurate observation of the habits of the classes of people among whom the malady is common.

Then there is a form of goitre which is very common in certain localities. Much work of the highest order has been carried out in connection with this disease by Lt.-Col. McCarrison but the results obtained are not easy to reconcile with what is known of the disease as it actually occurs in man. This is the case specially in connection with its geographical distribution and it seems quite possible that careful observation of the disease in the human subject may throw light on its true nature and on the means of preventing it.

The foregoing examples have been chosen with a view to suggesting that in medical research subjects under investigation should be examined from every point of view, and that we should look at the problems with the naked eye as well as with the microscope. It is also suggested that much may be learned by close observation of the experiments which human beings are carrying out on themselves all over the world.

It is not suggested that we should pay less attention to animal experiments, we cannot dispense with these, but still it

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is possible that we may have been too much inclined to neglect the more important human experiments which constitute the final and crucial tests in connection with any disease.

An aspect of medical research which is closely related to the last is that evidence should be sought from every available source. A classical example of the help that may come from outside sources is the work of Pasteur. He was not a doctor but a biochemist, and yet there never was a man who did more to advance the cause of medical research. Among those who can help are the chemists, the biochemists, the zoologists, the botanists, the veterinary scientists, the physicists and even the geologists.

Medical science has relationships and points of contact with nearly all the other sciences, and one of the most important problems of the future is to secure the help of other scientific workers and to ensure the most complete co-ordination between their work and ours. Science cannot be allowed to divide itself into watertight compartments and as medical research is by far the most important of the sciences from the point of view of the welfare of the human race it is essential that it should be able to command the aid and co-operation of all the others to the fullest extent. Some scientists go so far as to say that it is more important to undertake research work that is purely academic than to concentrate on problems that are likely to yield useful results: such a quixotic attitude may be tolerated but it cannot be encouraged at the expense of the public. In the case of medical research the workers are prepared to be judged by the practical value of the work done by them. They see many problems of the gravest importance to the human race which are waiting to be solved by them and all that they ask is to be given the facilities for solving them.

Acting on the principle of getting the greatest and the quickest returns they will gladly forego the credit that attaches to the working out of complicated and difficult problems and will not be ashamed to attain the desired object by the simplest and most direct means.

Only a few of the tasks which lie before the medical research worker in India have been mentioned. You all know that the work to be done is so great that it is not easy to decide where to begin, kala azar, leprosy, hookworm disease, the dysenteries and other bowel diseases, and the infectious diseases of the respiratory system are among some of the most important subjects for investigation. In the case of all these it is essential that laboratory work and clinical investigation should be carried out side by side and that there should be a broad and general survey as well as a minute investigation of details.

The most important of all the aspects of medical research has been kept to the last and I hope that I have not made the tactical mistake of exhausting your patience before com-

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ing to it. Medical research is not an end in itself, it is only a means to an end. It is only of value in so far as it leads to an improvement in the health and prosperity of the people, and it follows that the practical application of the results of research is of more immediate importance to the community than research itself. When we consider this aspect of the subject and look at the vast amount of knowledge of the great fatal diseases that has been accumulated by scientists, and then look at the degree to which this knowledge has been made use of in practice we have small grounds for self-congratulation.

It is well known to all who have thought about the matter that if every one were to put into practice what is known of the prevention of such diseases as cholera, plague, malaria, dysentery, tuberculosis, and other fatal diseases the average duration of human life in India would be doubled and the amount of sickness would be reduced to a small fraction of what it is. A few years ago such a statement might have been received with scepticism as being the sanguine estimate of an enthusiast but now that the claims of the sanitarian have been put to the most severe test, especially in the great war, there is no longer any reason for questioning their validity. This being the case we are called on to give a straight answer to the plain question, "Why do we not make more practical use of this life-saving knowledge that is in our possession?"

I know of only one excuse that would satisfy any reasonable person and that excuse is seldom or never made use of. It is that if we were to prevent all the preventable deaths in India the stress of population would inevitably become so great that no efforts on our part could increase the food supply to such an extent as to satisfy the needs of the people. We must face facts and it is quite obvious that if the well-meant efforts of the sanitarians for the past forty years had been attended with complete success the population of India would already be far too great to be supported by the food supply. We might almost be tempted to think that the passive resistance of the people to the efforts of the sanitary department were due to an instinctive knowledge that the victory over disease would lead to an evil even greater than disease, namely, inevitable famine. This is not a pleasant prospect to face and if there were nothing more to be said it would have been better to have said nothing at all and to have accepted the existing evils with the fatalistic apathy that has for so many centuries helped the people of India to endure their miseries. But while we must recognise the evil results that would follow from the sudden interference with the balance that has been arrived at in India by the working of natural laws through the ages, we have not exhausted the resources of civilization and there is no need for us to sit with folded hands. In other countries the death rate has been very

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greatly diminished and at the same time the problem of over population has not become acute. If we learn from the experience of these countries, we can find means for compensating the disturbance that will follow from a falling death rate. In India we have been trying to impose on the backward and uneducated masses rules and regulations which they have passively resisted. In the countries which have dealt successfully with the evils of epidemic disease the results have been attained by the willing co-operation of educated people, and the consequence has been that they themselves have arranged for maintaining the balance between food supply and population, by increasing the productiveness of the soil, by opening up new lands to receive the surplus population, by later marriages and other means.

By the spread of a rational system of education the people of India will not only learn to prevent the senseless waste that comes from preventable disease and death: they will also learn improved methods of agriculture; these combined with the betterment of the physique that will also result will lead to a great increase in the food supply. There are tracts of land which are now lying uncultivated which can be made to support millions of people and by the time that these measures fail to provide for the increasing population the people will have the knowledge that will enable them to deal with the problem for themselves. What is obviously needed is the spread of a form of education which will enable the people to become masters of their fates to much greater extent than is the case at present.

We cannot impose on the people of India a solution of the terrible problems that they have to face: what we can do is to give them the education that will show them the way out of their difficulties. The outlook on life of the masses of India is essentially the same as it was before science began to show mankind how to increase its mustery over its environment and until we educate the people from their childhood upwards there is no hope of any great advance being made. I will leave to others to decide what other changes should be made in the educational system of India but I strongly insist that it should be the aim of Government to ensure that every child should be taught how to avoid preventable disease and preventable death. The first step is to teach the teachers themselves, and to instruct them in the methods of conveying the knowledge to their pupils in a simple and intelligible manner. The great organisation of the educational department exists ready to hand, it can easily be adapted to the purpose of conveying an education which will be of real help to the pupils in their after lives. To deal with the adult population is much more difficult, they have acquired such an outlook on life that the teachings of medical science are a foreign language to them.

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At the same time experience has shown that the masses of India are by no means so conservative and so antagonistic to new ideas as we often assume, and it is quite likely that it is chiefly our methods of istruction that are to blame for the slight response that has been made up till now to our teaching.

I will not exhaust your patience by dwelling on this subject. My sole aim has been to show that medical research and its application represent a problem of the first magnitude and that a solution of this problem is of the most pressing urgency. If you agree with me in my conclusions, as I am sure you do, only two questions remain to be considered. One is, *who is to take action?* and the other is—*what action is to be taken.?* In considering the answer to the first question we must take into account the claim that has always been made for medical research by those who are engaged in it—that it pays. This claim has been amply justified over and over again. Let us regard the matter as a business proposition and let us suppose that the advocates of medical research were to go to a group of capitalists and were to explain to them the financial possibilities of medical research. The capitalists would doubtless agree that the returns which could be clearly foreseen from the application of medical research would be many times greater than those of all the great industries of India taken together, but they would also point out that these returns are like the benefits arising from the air and light of heaven, they cannot be monopolised for the profit of any company or syndicate owing to the fact that they can be taken advantage of by every member of the community without payment. For this reason it is clear that the business of exploiting the vast possibilities of medical research must be undertaken by the whole community. The trustees of the people are the Government and so it follows that it is the business of Government to shoulder the great responsibility.

But our duty does not end with telling the government that medical research is their concern, we cannot so easily wash our hands of the business. If I were placed in the position of a defender of the government I would argue that it has already done a great deal, quite as much, in fact, as has been demanded of it by public opinion, for it is quite certain that if there had been an insistent demand on the part of the public, government would have made a response which would have been in keeping with the strength of the demand. I would also say that now that the people have the right to elect their own representatives the matter is in their own hands and if they are dissatisfied with what has been done in the past, the best way of showing it is not by arguing as to what might have been done or should have been done, but by doing it themselves now. The sooner we realise that the grant of representa-

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tive institutions entails grave responsibilities on the people and on their representatives the better it will be for India.

Let me now put aside the role of an apologist for government and speak as one of the general public. I would say to government that there are two great functions to which you should give your special attention, the one is the maintenance of peace and order and the other is the care of the physical and mental welfare of the people. The first of these responsibilities has been reserved but the second has been made a transferred subject and it is up to us medical men to show both the government and the people what their duty in the matter is.

The next question is, "What must be done?"

The future of India depends on the choice of the right line of action. The choice of this line cannot be left to any individual nor should it be arrived at on the advice of well meaning enthusiasts. The whole subject should be closely examined by a committee of the most highly qualified men who can be secured. This committee must be a whole time one, it is useless to ask a few busy men to work out a scheme in the few moments that they can snatch from their other duties. On the committee there should be recognised leaders of medical research with experience of the east, men like Sir Leonard Rogers and Dr. Balfour of Khartoum fame. There should be a man with a special knowledge of applied sanitation in India, there should be an expert in medical education, an expert in general education, a general practitioner with special knowledge of Indian conditions, there should be a business expert and a recognised leader of public opinion. The committee should be given ample time and opportunity to take evidence and to examine the subject in whatever way it finds to be necesary and it should be given great latitude in the scope of its enquiries.

Among the terms of reference would be the following :—

(i) To consider the present position of medical research in India and the action that may be necessary to place it on a sound basis.

(ii) To consider the relations that exist between medica research and other forms of scientific research and the steps that should be taken to ensure the most effective co-operation between them.

(iii) To consider the steps that should be taken for the purpose of making the results of medical research available for the improvement of the physical, intellectual and economic condition of the people of India.

My last word to you and to the Government of India is this—Do you think it worth while to appoint such a committee?

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The weight at birth of infants in India.—*By* Dagmar F. Curjel.

Considerable interest is being shown in different parts of India at the present time in the subject of Maternity and Child Welfare, and various schemes are being put forward to improve the condition of the Indian mother and her child. The economic value of health in a community is now generally recognised, and the aim of all welfare work is to preserve the health of the mother and to ensure for each infant a healthy childhood.

In view of the very large number of infants who die before the end of the first year in India, the following enquiry was undertaken with the object of determining the condition of development as shown by weight, of the normal Indian infant at birth. For the purposes of the enquiry a normal infant was considered to be a full term birth, the presentation being either vertex or breech, where labour had terminated naturally and spontaneously. The weights at birth of 1849 normal infants were collected in different parts of India, and for comparison the weights at birth of 289 normal infants born in India of other than Indian parentage.

Results :—

(1) Records of the weights at birth of 1,849 normal Indian infants representing many different castes and classes, show that the Indian infant has reached at the time of birth the average weight of 6·5 lb.

(2) This average compares favourably with the weights at birth of infants of other parentage born in India.

(3) There is no marked difference in development as shown by the average weight at birth of normal infants between Mussalmans, Hindus and Indian Christians.

(4) The early marriage age of the Indian mother as compared with European races, does not adversely affect the development as shown by weight, of her child at birth.

(5) Since the normal Indian infant has reached a fair development as shown by the average weights of 6·5 lb. at birth, the subsequent high mortality among such children is largely due to unfavourable post-natal conditions, which are intimately connected with the environmental factors affecting the health of the community generally.

The difficulties in the manufacture and use of vaccine lymph in the Madras Presidency:—*By* M. Kesava Pai *and* T. N. S. Raghavachari.

Introductory.

The vaccination results in the Madras Presidency during the last twenty years have been far from satisfactory. Other institutes in India and Burma have been getting a case success of 95 per cent and over, whilst in Madras the rate has been as low as 80 per cent.

Aim of the Paper.

The aim of the present paper is to set forth the several factors that have contributed to the low success rate.

Climate.

The climatic conditions obtaining at the depot are unfavourable to lymph production. The comparatively high temperature of the districts

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during the greater part of the year and the continuance of vaccine operations all through the year have contributed to these poor results.

The Vaccinifer.

Calves of suitable size and good physique are difficult to obtain to meet the large requirements and the absence of sufficient pasture in the premises of the institute has added to the difficulties of maintaining a healthy and robust set of calves required for the production of a potent virus.

The Maintenance of the Seed.

The system of passing the vaccine virus from calf to calf with preserved glycerinated emulsion of the pulp, ends in loss of virulence after 5 or 6 passages. The system of direct transfer has yielded, what appears to be satisfactory results, as judged by 16 moves from calf to calf so far made. The maximum potency of the virus is reached in the cold weather at the end of 120 hours; in the hotter months, however, vesicles are found to mature at 96 hours or even earlier, but these are inferior in quality to the vesicles of 120 hours.

Grinding and mixing the Pulp.

The use of mortars and pestles for grinding the pulp has not yielded satisfactory results. The use of a grinding machine (Chalybaus or Doering's) is quite necessary to ensure minute sub-division of the pulp material and its uniform distribution in the final product.

The Choice of the Vehicle for the Vaccine Virus.

King used lanoline and claimed for it the advantages, of its being a neutral vehicle without any antiseptic action on the virus, a bad conductor of heat and an unfavourable medium for the entry and multiplication of extraneous organisms.

Other observers in India have found that lanoline is most unsuitable for the purpose for several cogent reasons, and that glycerine is a much more satisfactory vehicle.

Experimental Study of Chloroformed Glycerine Lymph, Unchloroformed Glycerine Lymph with and Lanoline Lymph reference to their relative efficacy and keeping Properties.

Chloroformed glycerine lymph was found to resist almost all adverse influences of climate and to yield excellent results. Unchloroformed glycerine lymph though inferior to the former, as regards its keeping properties and potency, was found to be definitely superior to lanolinated lymph.

Storage of the Lymph.

Storage of lanoline lymph for long periods was found to tell very much on the potency of the virus as revealed by the results of vaccination during the period 1912-1920, when cold storage was resorted to largely, consequent on the temporary intermission of calf operations during the hotter months of the year.

Avoidance of exposure to heat is the all important factor during the whole process of manufacture. The preservation of the vaccine after manufacture till the time of despatch by post, at as low a temperature as

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possible, should be zealously attended to, guarding against large variations even at that low temperature.

Loading and Packing the Lymph.

Metal collapsible tubes are not at all suitable for the purpose. Glass tubes plugged with corks are the ideal ones for loading and issue. They should be packed, while still cold, in wooden cases also plugged with corks and then sent out.

The Use of Lymph by Vaccinators.

The system of weekly supplies, instead of the supplies now made three times a month, is a great advantage and supplies for 10 and 20 cases in each tube should be made instead of the full requirements of 10 to 150 cases in one tube as now. These two improvements would greatly assist in securing a higher rate of success, by giving the vaccinator a sufficient number of working days in the month in which to make up his minimum cases and by obviating the necessity of having to open his vaccine stock tube several times during one tour.

The rotary lancet in use in the Bombay Presidency appears to be a much better instrument for vaccinating babies than the knife-edged spatula-shaped lancet of Madras. The former produces neat, circular and symmetrical vesicles of standard size and shape and causes the minimum of disfigurement.

Conclusions.

(1) Considering the poor physical condition of the calves available in Madras, every attention should be paid to their selection, cleanliness and feeding before the animal is utilised for vaccination.

(2) To keep up the potency of the seed the method of direct transfer from calf to calf should be tried, the best calves with softest and fairest skins being selected for this purpose. Whether, with this method of direct transfer, it will still be necessary to pass the virus through a different species of vaccinifer, such as a rabbit, after a certain number of moves from calf to calf, is to be ascertained by actual experience.

(3) The extraction of the pulp from the calf should be made preferably at the end of 120 hours, vesicles of less than that duration being discarded as far as possible.

(4) The later processes of grinding, mixing and loading should be conducted in a cool atmosphere, an artificially cooled room being preferable, except during the coldest months.

(5) A cold store with a steady temperature of about—10°C. is a necessity especially as vaccine operations on the calf have to be stopped during the hotter months, when stored lymph has to be issued.

(6) Every attempt should be made to see if glycerine lymph can be adopted in place of the lanoline lymph now in use. Whether chloroforming of the lymph is desirable or not is to be ascertained by actual experiment and cautious adoption.

(7) The method of packing and despatch should be very carefully attended to, the glass lymph tube enclosed in the corked wooden case being preferred to the collapsible metal tube packed directly in the cardboard box.

(8) Vaccination of children can, with advantage, be suspended during the hotter months, except in infected areas, where vaccination has to be carried out as an emergency measure, even in the hottest part of the year.

(9) The vaccinators ought to be given a thorough practical training enabling them to minimise the adverse effects of the climate on the vaccine lymph, the operation and its results.

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(10) If, in spite of close attention to all the above details vaccination continues to give unsatisfactory results, the desirability of removing the vaccine depot to a hill station, has to be seriously considered.

The influence of age and temperature on bacterial vaccines.—*By* W. F. HARVEY, K. R. K. IYENGAR *and* S. R. CHRISTOPHERS.

It is rather difficult to give a single quantitative expression to the effect of age and of temperature upon the bacterial antigens used in these trials. As far as our results go, however, there is no evidence on which to incriminate age and temperature as causing appreciable deterioration of vaccine up to a period of 12 months. This is a specially remarkable fact in the case of temperature, and if confirmed will necessitate a revision of our ideas on the means necessary for preservation of vaccines. On the evidence here submitted it would appear that there is no reason for the adoption of any elaborate precautions for preservation of vaccines. The antigenic power of a vaccine kept continuously for 48 weeks at a temperature of 37°C is apparently as good at the end of 48 weeks as it is when freshly administered. To cover all possibilities, and at the same time to err on the side of safety, it might be advisable to use the vaccines here dealt with with some increase of dose rather than to reject them at some given date as useless. Another feature which is well brought out in these experiments is the wide range of variation in response to inoculation of antigen exhibited by different individuals among the experimental animals. In the case of the Cholera antigen the measurable turbidity of the antigenic suspension fell somewhat rapidly from its value when freshly prepared but did not undergo any very rapid changes subsequently. In the case of the typhoid antigen there was little change in turbidity throughout the period of trial whether for antigen kept at room temperature or kept at 37°C. It does not follow of course, that with autolysis, antigenic power should be lost at all. It does not seem necessary likewise to keep antigen suspensions such are used in agglutination tests at cold storage temperature. They may, so far as turbidity is a gauge of their condition be allowed to reach a stable position when they will retain that position for 12 months at least, at room temperature.

In the experiments shown for the 8th and 12th week of preservation there is evidence of actual increase in antigenic power. We refrain from drawing any conclusions meanwhile from these two results. Our conclusions are :—Typhoid and Cholera Vaccines do not deteriorate in antigenic potency as judged by agglutination response, within twelve months. or at any temperature to which they are likely to be exposed during that period.

The production of *B. influenzae* vaccine on a large scale — *By* R. H. MALONE.

By the method described in this paper, the organisms are grown in a special fluid medium in which rapid sedimentation occurs. The supernatant fluid is removed by means of a suction pump, and the sediment suspended in saline and used as a vaccine.

The culture medium employed is Douglas mutton broth, P_H7·2 to 7·4, containing 0·5 per cent heated pigeon blood and 0·5 per cent glucose.

This procedure results in a saving of time, labour, and material, and allows of a more rapid production of influenza vaccine on a large scale than the methods commonly employed.

The viability of bacterial cultures.—*By* NAND LAL.

1. Sealing of cultures is an important factor in their preservation.
2. Haemophilic organisms such as the Meningococcus, Gonococcus

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and B. influenzae can be preserved for at least 50 to 60 days without sub-culture.

The re-use of media.—*By* Nand Lal.

1. Succesive crops of an organism may be obtained by re-use of the same medium.

2. Successive crops of a second and even a third organism may be obtained by re-use of a medium which has been exhausted for another organism.

3. Some organisms will not grow on a medium which has been exhausted by another organism.

Preservation of high titre agglutinating serum and corresponding antigen.—*By* G. Mackey.

1. Antigen suspensions used for agglutination purposes preserve their agglutinability for a considerable time at ordinary room temperatures.

2. Agglutinating antisera lose their potency only at a slow rate when kept at room temperature. A. M. melitensis serum loses its potency more rapidly than a B. paratyphosus B. serum.

3. Agglutinating antisera may lose their potency comparatively slowly when kept at 37°C as in the case of a B. paratyphosus B. serum or rapidly even to complete loss as in the case of a M. melitensis serum.

The Wassermann reaction in syphilis and in other diseases.—*By* K. R. K. Iyengar.

When Wassermann applied the Bordet-Gengou Phenomenon to the diagnosis of Syphilis, it was considered a specific reaction. He used a specific antigen and the reaction was explained on the Antigen-Antibody theory. Now most workers use a non-specific antigen and the reaction can no longer be explained on the Antigen-Antibody theory. The nature of the Wassermann test is still obscure. It is of the utmost importance and particularly in tropical countries to ascertain which are the diseases that give a positive Wassermann reaction other than Syphilis. A positive reaction is given by Leprosy and Relapsing Fever. Malaria and Tuberculosis do not give this reaction.

Relation between impure water and disease.—*By* V. Govinda Raju.

The paper is a critical examination of the mortality statistics of certain towns in Bengal and particularly the town of Hooghly, Chinsura. This town has a population of 29,000 and recently installed a filtered water-supply both sufficient in quantity and satisfactory in quality. The effect of this on mortality rates in this town has been taken as typical of the relation subsisting between an impure water-supply and disease. In this town during the ten years preceding the introduction of water-supply the death rate from Cholera ranged from 3·4 to 9·46 per 1000 with an average of 5·43. After the introduction of pipe water-supply the death rate from Cholera fell to an average of ·61 per 1000 and ranged from ·3 to ·9. The provision of water-supply has thus led to a considerable reduction in Cholera mortality. A similar reduction has also been observed in the case of "Fever" mortality rates. During the pre-water works period the death rate for fever for the above town, varied from 16·09 per 1000 to 25·35. After the introduction of water-supply, the death rate from 'fever' varied from 12·31 to 9·57 per 1000 with an average of 10·87 per 1000 against 19·44 for the former period. In the case of Diarrhoea,

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Dysentery also a reduction has been noticed. Omitting the deaths due to Cholera and injury the total mortality rate for the pre-water-works period was 36·14 (average of ten years) while the rate for the period after the provision of water-supply is 24·42 (average of five years) which means a reduction of 11·72 per 1000 on the general death rate apart from Cholera and injury.

The following conclusions are drawn :—

(1) That Cholera mortality in these towns of Bengal is mostly water-borne or at any rate can be reduced considerably by the provision of an abundant pure water-supply.

(2) That in the case of the town of Hooghly, Chinsurah, where one death from Cholera has been avoided as a result of the introduction of a pipe water-supply two to three deaths from other causes have been avoided as well.

Studies in town water-supplies.—*By* V. Govinda Raju.

It is an enquiry into the methods of purification of water employed in Bengal towns. It is pointed out that in the smaller water works the methods of purification adopted bring about very little improvement in the bacterial contents of waters and hence it is claimed that the money spent in installing these filtration-plants is practically wasted as the only justification for the expenditure of large sums of money on filtration-plants is the epidemeological safety thereby assured. The methods adopted in European countries are unsuited to India as here economic conditions are generally on a lower level and preclude the carrying out of efficient and up-to-date schemes. It is therefore necessary that there should be an investigation as to the suitability of various methods of water purification for different localities. In tropical climates storage brings about a particularly remarkable improvement in the bacterial contents of polluted waters and consequently for small communities tank waters after being subject to some days' storage form excellent sources of water-supply without any artificial process of purification provided pumps are provided and measures are taken to retain the water free from contamination at the edges by men or cattle. In larger towns where it is necessary to have a distributory system some form of purification will have to be provided. The relative advantages and disadvantages of slow sand and mechanical filters for these localities must be carefully considered. In the latter case large amounts of coagulates are necessary and in consequence the maintenance charges are likely to be heavy. Although said to be fool proof in actual practice they have in most cases not yielded satisfactory results. Slow sand filters have given excellent results on a large scale, but in the case of the smaller plants the results have not been satisfactory. This however is believed to be due to faulty design.

New thoracic appendages in anopheline larvae.—*By* M. O Tirunarayana Iyengar.

The paper deals about the occurrence of a paired appendage on the sub-dorsal region of the meso-thorax of anopheline larvae, which appears to be characteristic of this group as no other culicines studied have them. The appendage is very transparent and consists of a basal pedicel terminating in two lobes which are provided with cuticular expansions. The appendages are capable of movement and contraction by the action of an oblique muscle strand. The exact functional relations of these organs are not known nor their homology. All the nine species so far studied have these appendages, i.e. *Anopheles barbirostris*, *sinensis*, *rossi*, *stephensi*, *minimus*, *culicifacies*, *fuliginosus*, *jamesi* and *maculatus*. The author has also found these appendages in the larvae of *A. maculipennis* and *bifurcatus* from England.

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A review of recent investigations on margosic salts and esters and a comparative study of margosic and other esters.—*By* K. K. CHATTERJI.

I. Introductory.

Formula of margosic acid.

II. Margosic acid and its salts.

(*a*) Biological tests. Table I.
(*b*) Bacteriological tests.
Technique. Table II.
(*c*) Tests on protozoa.
Technique. Table III.
(*d*) Haemolytic action of margosates.
Comparative hoemolytic tests with
pot. chaulmoograte,
pot. morrhuate,
pot. oleate. Table IV.

III. Esters of margosic and other fatty acids.

(*a*) Ethyl esters.
Esters of margosa oil.
,, ,, cod liver oil.
,, ,, teel oil.
,, ,, castor oil.
etc., etc., etc.
(*a*) Bacteriological tests of esters of different fatty acids.
Technique. Table V.
(*b*) Experiments with protozoa.
Technique. Table VI.
(*c*) Influence of esters of different fatty acids on metabolism.
(*β*) Allyl esters of margosic and other acids.
Compared with ethyl esters,
chemically and physiologically,
clinically.

IV. Copper Margosate.

Method of preparation.
Bacteriological tests.
Biological tests.
Clinical use in cancer.

V. Silver Margosate.

Method of preparation.
Bacteriological tests.
Biological test.
Clinically: its use in gonorrhoeal urethritis.

The treatment of Kala-azar with some new antimonial preparations.—*By* U. N. BRAHMACHARI.

This paper contains my experiences in the treatment of kala-azar with the following new antimonial preparations:—

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(1) Urea-antimonyl tartrate.
(2) Ammonium hyperacid antimonyl tartrate.
(3) Phenyl stibiate of sodium.
(4) Stibenyl.

These preparations have been used by me either intra-venously or intramuscularly or both and the effects of treatment are detailed in my paper. The focal reactions in cases in which they were used *Intramuscularly* are also pointed out.

Quinine haemoglobinuria and the dangers of rapid intravenous injection of concentrated solution of quinine in the treatment of malarial fever.—*By* U. N. Brahmachari.

The first part of this paper refers to cases, which one occasionally meets with. One such recent case is fully described in this paper. Patient had an attack of malarial fever six months ago. After administration of 10 grains of quinine by the mouth he had haemoglobinuria. He had recently another attack of malarial fever, ring parasites being found in the blood. Quinine was given intramuscularly. This was followed by haemoglobinuria. The paper is intended to open a discussion on the treatment of such cases.

The second part of this paper refers to the dangerous fall of blood pressure that may follow intravenous injection of concentrated solutions of quinine, in the treatment of malarial fever. In my opinion quinine should be given in dilutions of 10 grains of the bihydrochloride dissolved in 200 c.c. in not less than 20 minutes in the case of adults and the rate should be still slower in the case of patients under 15 years of age. Bayliss' solution does not prevent the fall of blood pressure that may take place after intravenous injection of quinine given without proper precautions.

Notes on relapsing fever —*By* P. Basu.

Two different types of Relapsing Fever occur in India both of which are caused by Spirilla, but these are morphologically distinct from each other. One has already been described as the cause of Indian Relapsing Fever but the other variety is common in Punjab. In the first type signs and symptoms exactly similar to those described as Indian Relapsing Fever (caused by Spiroschandinnia carteri) are noticed. The cases generally show an initial fever which continues from three to four days during which time Spirochaetes are freely found in the circulating blood. Vomiting, slight enlargement of spleen and jaundice are usual concomitants. In some cases complications (bronchitis, cerebral symptoms, etc.) develop. These cases generally get a relapse within six to ten (often 7) days, and sometimes even a second relapse.

In the second type, i.e. the Punjab type which is very common and has not hitherto been described, the symptoms are less severe.

The initial fever starts with rigor and lasts for two or three days without any sign of vomiting, or enlargement of spleen. Complications are rare and the relapses are uncommon. The morphological characters of this Spirillum are quite different from the first. It shows less spirillation, the curve being more opened out and thread is usually doubled or coiled up. In fact the main differences between the first and second types are as follows :—

Character.	Spirillum Carteri.	Spirillum of Punjab variety (2nd type).
Length	.. Longer spiral more than 3.	Short spiral, not more than 3.
Curve	.. Open curve	.. Open curve, usually doubled up.

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Character.	Spirillum Carteri.	Spirillum of Punjab variety (2nd type).
Symptoms ..	Severe	Less severe.
Complications ..	Present	*Nil.*
Relapses ..	Twice or thrice ..	*Nil.*
Mortality ..	Few	*Nil.*

Etiology.

The disease is carried by lice and bed bugs.

Treatment.

Prophylactic treatment consists in systematic disinfection of clothing, bedding, and in the personal cleanliness of each man of the unit in which infection has taken place. Medicinal treatment consists in the immediate intravenous injection ·45 grm. of novoarsenobillon. Antimony salts have got no effect. Quinine is useless.

Fatty acids in the treatment of diseases caused by acid-fast germ.—*By* P. GANGULI.

I. Evolution.

The properties of Chaulmoogra, Nim and Gurjan oils were extolled in Aurvedas in the treatment of leprosy, syphilis and other skin diseases. In 1905, Dycke found that the parasitic nature of the acid fast bacilli were due to a fatty substance in their bodies which conferred the great resisting powers in them so that the antibodies were unable to penetrate their fatty envelops. He introduced Nastin-B—a combination of Benzoil Chloride with a fatty principle from lepra streptothrix which was remarkably successful in the treatment of leprosy. Rogers introduced the treatment of leprosy and tuberculosis with the salts of unsaturated fatty acids of Chaulmoograe and Morrhvae oils. Chatterji introduced various preparations of Margosic acids in the treatment of leprosy, syphilis, cancer and various skin diseases. Shaw-Mackenzie uses Sodium Oleate in cancer. The most important declaration was that from Rogers when he pronounced before the Leprosy Conference 1919, that the bacteriolytic properties resided in the unsaturated fatty acids as a class.

II. Action of fatty acids.

1. The injection of fatty acids restrains the vital action of the acid-fast germs, by inducing an *antiseptic atmosphere* and thereby inhibiting their production of toxins which are responsible for fever, malaise and other symptoms.

2. The injection of fatty acids removes the inhibitory action of serum on *lipase* and accelerate the fat splitting activity of *lipase* in the serum (Shaw-Mackenzie). The most important effect is that it excites the production of partial antibodies for bacillary fats which causes breaking down of the bacilli and formation of an emulsion of bacillary proteins which acting as auto-antigen excites the formation of specific albuminolysius causing focal and general reactions.

3. Besides above, a fibrolytic property of the fatty acids has been discovered which is active against newly formed fibrous tissues. It is responsible for the elimination of latent tubercular foci from the system and thus effecting a more permanent cure of pulmonary tuberculosis, if treated with fatty acids.

4. Lastly, there is a great possibility of fatty acids as adjuvants of various drugs of antibodies seeking penetration of cells of animal organisms as the protoplasmic membranes of the cells are of lipoid nature and

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osmosis depends on the ability of the membrane to differentiate by solvant or absorbant action between the substances which seek to pass through it.

III. Posology.

Determination of the initial dose of fatty acids in pulmonary tuberculosis is very important as too small doses or too large doses are both liable to produce hypersusceptibility. The proper procedure is to test the susceptibility of a patient by putting him to certain moderate exercises and noting reactions after that. Exercise is also a valuable diagnostic method superior to inoculation with Old Tuberculin in active cases. The afebrile and febrile cases of pulmonary tuberculosis can be classified into subsensitive, moderately sensitive and supersensitive types according to reactions after exercise. The initial dose should be $\frac{1}{8}$ to $\frac{1}{2}$ c.c. of a 3 per cent solution of Sodium Morrhuate according to severity of reaction. The maximum dose is 5 c.c. Fatty acids are contra-indicated in high intermittent supersensitive type.

IV. Role of fatty acids.

Fatty acids are superior to *Tuberculin T.A.*, as in the latter, tox-immunity only is established, whereas in the former, tox-immunity and bactero-immunity are simultaneously produced. But, in a recent infection of supersensitive type, *fatty acid* treatment should be preceded by that with *Tuberculin T.A.*, with a view to get tox-immunity. Fatty acids are best indicated when tox-immunity has been fairly established in active cases. Again, to attain high ideal immunity, *fatty acid* treatment should always be followed by that with *bacillary substances.*

Note on some cultural phases of *Leishanania donovani.*—*By* B. M. Das-Gupta.

A monkey was infected with kala-azar by intraperitoneal injection of spleen emulsion from a kala-azar spleen. The incubation period was 85 days. The animal shewed great splenic enlargement. All attempts to find parasites in spleen puncture films and on post-mortem were negative: but N.N.N. cultures were successful. One series of such cultures, after shewing the usual and typical flagellate phase and rosettes, went on to shew aflagellate and granule forms resembling those described by Dr. Row as "post- and super-post-flagellate" forms. A second series of cultures, after shewing the usual flagellate types, went on to cyst formation with finally rupture of the cysts, and de-excystation of very small and very minute "second generation flagellates." The aflagellate and granule forms appear to be simply degenerating flagellates: but the process of encystation of L.D. appear to be a vital one, and may possibly be a part of the extrahuman cycle.

"Naga Sore."—*By* E. C. R. Fox.

Naga sore or Cachar boil is endemic in Assam and at times becomes epidemic. It is shown to be identical with Tropical ulcer as met with in various parts of the Tropical world.

The fusiform bacillus and spirochaetes met with in this condition appear to be identical with those seen in Vincent's disease. The carrier of the infection appears to be the small green fly. Siphonella funicola, and the occurrence of an epidemic is associated with the presence of this fly in large numbers.

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Section of Anthropology and Ethnography.

President :—Rai Bahadur Sarat Chandra Roy, M.A., B.L., M.L.C.

Presidential Address.

Anthropological Research in India.

All students of Anthropology in India will, I am sure, join with me in offering their hearty thanks to the Executive Committee of the Indian Science Congress for having at length agreed to have a separate and independent section of Anthropology. My first impulse on receiving, late last year, the flattering invitation to preside over the meetings of this section was to thankfully decline the honour on the ground of unfitness. Apprehending however that further delay thus caused in selecting a President might perhaps lead to a further postponement of the inauguration, or, more correctly, the revival of a much-needed separate anthropological section, I felt bound to accept the invitation as a call of duty. And so I beg to offer my grateful thanks to you all, gentlemen, for having done me the high honour of electing me President of this section. Although I am painfully conscious of my own unfitness to fill the onerous task of presiding over the meetings of such a learned body, my only excuse for standing here to-day is my ardent devotion to the science and my recognition of its paramount claims to our attention and service.

The claim of Anthropology to be recognized as an important science can no longer be seriously disputed even by the votaries of the exact sciences. Such a rigorous critic of science as Prof. Karl Pearson, the celebrated author of the *Grammar of Science*, in his Presidential Address to the Anthropological section of the British Association for the Advancement of Science, at its eighty-eighth annual meeting held at Cardiff in August last, declared that Anthropology should hold the position of the "Queen of Sciences, and form the crowning study of the academic curriculum." And he emphasized the necessity of having institutes of Anthropology for teaching and research in order to place anthropological science in its true position.

Although but few learned societies in India have paid adequate attention in the past to the claims of this science, and Indian Universities have hitherto ignored those claims, there are fortunately indications that Indian scholars and educationists are now slowly waking up to the necessity of having suitable institutions in this country for anthropological study and research. And it augurs well for the future of anthropological research in India that latterly a few research societies in the country are paying increasing attention to the

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science, and more than one Indian University have introduced Anthropology as a subject for their degree examinations; and at least in one University—the premier University of Calcutta adequate provision for regular instruction in the science is being made by the creation of Chairs, Lecturerships and Readerships and the formation of an Anthropological Museum and Laboratory. It is none too early therefore that the Executive Committee of the Indian Science Congress have at length decided to have an independent section of Anthropology—a section which though nominally inaugurated in the first year ceased to have an independent existence since the second. We may now confidently expect that succeeding sessions of this Congress will be welcomed by an ever-increasing number of votaries of the science all over India as suitable occasions when they may come together once a year to exchange ideas, report some of the interesting results of their year's anthropological work, and discuss methods that may be usefully followed and problems that await to be seriously tackled and solved.

As this is practically the first sitting of an independent anthropological section of the Congress, it is perhaps fitting that we should take a rapid survey of the anthropological work so far done in India, and form a rough estimate of the enormous work that awaits to be done in the future.

Paucity of Indian workers in Anthropology.

In reviewing the past history of anthropological research in India, the first thing that strikes the Indian student and makes him hang down his head in shame is that up till the present, almost all that has been accomplished has been the work of European investigators whereas we Indians have culpably neglected to take our proper share in the work. Instead of taking, as we should have done, a leading part in that work, a few of us have contributed in periodicals only occasional papers of ethnological interest written mostly by way of intellectual pastime during intervals of other business; and only a few others have taken generally the minor part of collectors of information for official compilers of Gazetteers and Handbooks on Castes and Tribes. And it must be confessed that hardly any systematic anthropological work by an organized band of devoted workers has yet been seriously attempted in this country. This is all the more to be regretted as but few countries present a wider field for anthropological investigation and afford promise of a richer harvest.

The ethnological work hitherto done in India falls roughly into three classes: (1) Magazine Articles and Articles in the Journals of learned Societies; (2) Government Reports and Handbooks on Castes and Tribes; and (3) Monographs on particular Tribes or Castes.

It is to the Asiatic Society of Bengal that we owe the

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Magazine Articles.

beginnings of anthropological investigation in this country. It is to that society, the scope of whose inquiries was laid down in 1774 in the inaugural address by its founder and first President Sir William Jones, as "the entire field comprised in the words Man and Nature," that modern research in Indian Ethnography and Ethnology may be said to owe its foundation.

But how insignificant has been the part taken by Indian Scholars in laying down those foundations and building up the superstructure may be judged from the fact that within the first hundred years of the establishment of the Asiatic Society of Bengal—from 1784 to 1883,—out of a little over one hundred anthropological papers published in the Society's Journal and Proceedings, the contributions of Indian writers did not amount to more than three short papers—and those of comparatively minor importance,—namely, one on "The Trial of Ordeal among the Hindus" written by Ali Ibrahim Khan (Magistrate of Benares) and communicated to the Society by Warren Hastings in 1784 (*Asiatic Researches*, Vol. I, p. 323), a second on "The Shiaposh Tribe or Reputed Descendants of the Macedonians," by one Mr. Mohan Lal in 1834 (*Asiatic Researches*, Vol. III, p. 76), and a third on "The Esafzai Afghans" by one Khash Ali in 1845 (J.A.S.B., Vol. XIV, p. 736). The rest were all from the pens of European writers, mainly, if not wholly, Government officials or Christian missionaries. It was during this period that our first definite knowledge regarding the wild tribes of India began to be gradually accumulated in the pages of the Society's Journal through the contributions mostly of European writers. Thus, our first definite knowledge of the ethnography of the hill tribes of Hindusthan north of the Vindhyas was practically derived during this period mostly from articles contributed to the Journal by such pioneer workers as Lieutenant Tickell who, between the years 1840 and 1842, wrote about the Hos of the Singhbhum District and the Bendkars of the Keonjhar State, Colonel Sherwell who, in 1851, wrote about the Malers or Paharias of the Rajmahal hills, E. A. Samuels who in 1858, gave an interesting account of the Juangs of the Keonjhar and Dhenkanal States in Orissa, Dr. F. L. Stewart who, in 1865, wrote about the Bogshas of Upper India and Colonel Dalton who between the years 1865 and 1872, contributed several interesting papers about the hill tribes of Chota Nagpur and Orissa.

Similarly, it was during this period that the investigations of such European writers as Dalton, Hodgson, Robinson, Rawlins, Elliott, Rowlatt, MacRae, Wilcox, Reynolds, Barbe, O'Donnel, Otto de Grange, Lieutenant Yule, C. S. Campbell, and Rev. F. Mason, brought together a mass of information regarding the tribes of Assam and the North-Eastern Frontier of India: such investigators as Hodgson, McCosh, Wood-Mason, and

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A. Campbell published in the pages of the Society's Journal an amount of information regarding the tribes of Nepal, Sikkim and other Sub-Himalayan tracts; writers like Hodgson, Balfour, Lieutenant-Colonel Showers and others contributed articles in the Journal regarding the tribes of Central India; and investigators like Hodgson, Ward, Ross and others published in the Journal the earliest accounts of the tribes of Southern India.

Another more popular journal—the Calcutta Review—which was started in Calcutta under European Editorship in the year 1843 also published from time to time some illuminating articles on Indian tribes and castes which supplemented our earlier knowledge of the ethnology of India; but here, too, the majority of writers on ethnographical subjects were Europeans. Thus, out of fifty-three articles on Ethnology and Folklore published in the Calcutta Review from 1843 to 1883, as many as forty-three were from the pens of European contributors. As in these journals so also in the Indian Antiquary which was started at Bombay in 1872 by Dr. Burgess as a powerful rival to certain sections of the Asiatic Society's Journal, the number of European contributors of articles on Indian Ethnology and Folklore has been very much larger than that of Indian contributors. Thus out of over two hundred and sixty such articles and notes which appeared in the Indian Antiquary from 1872 to 1883, hardly more than a dozen articles were contributed by Indian writers.

Since 1883, although we have a slightly better account to give of ourselves, Indian writers on anthropological subjects still remain in a hopeless minority. Thus, out of about two hundred and fifteen articles and short notes on Ethnography and Folklore that appeared in the Proceedings, Journals and Memoirs of the Asiatic Society of Bengal from 1884 to 1920, not more than sixty-five were contributed by Indians. Similarly, out of about seventy-six anthropological articles in the Calcutta Review from 1884 to 1920, only thirty were from the pens of Indian writers, and Indians are responsible for no more than one-hundred and thirty-two out of a total of about four hundred and seventy-seven articles on anthropological subjects that appeared in the Indian Antiquary from 1884 to 1920.

You will have noticed the comparative increase in the number of anthropological notes and articles in the Asiatic Society's Journal during this second period. This is partly due to the action of Government which from time to time felt the necessity, for administrative purposes, of having better information about the customs and mentality of the people of India. Thus, in 1891–92, the Government of India circulated to the Provincial Governments and Administrations a scheme prepared by Risley for promoting the systematic study of ethnography in India, and it was suggested that societies formed for scientific enquiries might undertake to collate and

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publish information sent to them. It was in pursuance of this suggestion that the Asiatic Society of Bengal added to its Journal a third part dealing with Anthropology, Ethnology and Folklore. And the Government of Bengal, on the 7th November, 1892, sanctioned a grant of two thousand rupees to meet the cost of this third part of the Journal and, in the same year, the Assam Administration made a grant of rupees one thousand a year to the Society for ethnographic work. In the next nine years, from 1893 to 1901, fifty-nine anthropological papers were received by the Society for publication in its Journal. But the amount and quality of information thus published proved to be very poor. The number of really good papers such as the one on "The Religion and Customs of the Oraons" by the Rev Father Dehon and another on "Mundari Poetry" by the Rev. Father Hoffmann, was disappointingly small. The Council of the Society in their anxiety to improve matters now resolved to add to the third part of their Journal an Ethnographic Supplement on the lines of the short-lived "Punjab Notes and Queries." Only two copies of this Supplement were, however, published in 1903, when the then Anthropological Secretary, Mr. (afterwards Sir Edward) Gait having proceeded home on furlough it was unfortunately discontinued.

In these Ethnographic Supplements, too, out of the fairly large number of short notes contained in them, only a very few were contributed by Indians. Thus, of the forty-eight short notes or paragraphs in the first Supplement, only six were contributed by Indian gentlemen and the rest by Europeans, mostly Magistrates and Missionaries. Officers of Government had indeed an incentive for such work which non-officials did not possess. Again, on the 7th February, 1907, we find the then Lieutenant-Governor of Bengal, Sir Andrew Fraser, in his annual Presidential Address to the Asiatic Society expressing his regret that so few officers of the Indian Civil Service and other services were members of the Society and contributors of papers regarding religious legends, family or caste observances and similar ethnographic information. In consequence of these remarks, a committee was appointed to consider "the question of directing and encouraging research, and promoting knowledge of Indian life and conditions amongst Government officers in the province." And in order that the Society might act "as a centre of reference and bureau of information for all Government officers in Bengal who desire to pursue researches in connection with the history, religion, usages and folklore," it was proposed to appoint an officer who might "reply to any questions, suggest sources of information, course of study, method of treatment, etc." The Government which was requested to meet the expenses, sanctioned on the 2nd of December, 1908, an annual grant of three thousand six

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hundred rupees for payment of a monthly allowance of three hundred rupees to the officer to be placed in charge of the Bureau, and Mahamahopadhyaya Pandit Hara Prasad Shastri was selected for the purpose. The utility and importance of this Bureau consisted in the services it was calculated to render to Government officers requiring expert assistance and guidance in anthropological investigation. Very few officers would, however, appear to have availed themselves of the facilities for anthropological study thus provided. At any rate, the anthropological section of the Journal does not appear to have been since enriched by any appreciable increase in the number of contributions from Government officers. And non-official Indians have been generally as indifferent to the claims of Anthropology as ever.

Other provinces in India have unfortunately much the same story to tell. Thus, in Punjab, Denzil Ibbetson, in the preface to his Report on the Punjab Census of 1881, drew attention to "the extraordinary interest of the material which lies in such abundance ready to the hand of all Indian officials, and which would, if collected and recorded, be of such immense value to students of sociology." And, in 1883, the "Punjab Notes and Queries," to which I have incidentally referred, was started under the editorship of Captain Temple with a similar object as the later Ethnographic Supplement to the Journal of the Bengal Asiatic Society, but within five years, in 1887, became similarly defunct. In the North Western Provinces, a similar periodical started in 1891 under the editorship of the distinguished Anthropologist Dr. William Crooke, then a member of the Indian Civil Service, under the title of "North Indian Notes and Queries" with the same object of collecting "authentic notes and scraps of information regarding the country and the people," shared the same fate in 1896. In Bombay, although an Anthropological Society has been in existence since 1886, and has published in its Journal some really good papers, the number of its members who like Mr. Saldanha or Mr. Modi, take an enthusiastic part in the Society's work, appears to be disappointingly small, and solid contributions by the society to our stock of anthropological knowledge have thus been necessarily scanty.

The Mythic Society of Bangalore, started in 1909, and the Bihar and Orissa Research Society, started in 1915, have each tried to contribute its humble mite to Anthropological research in India, but these, like the other societies, suffer from want of adequate practical support and co-operation from Indian students and scholars. And we find Sir Edward Gait, the first President and founder of the Bihar and Orissa Research Society, in his last annual Presidential Address on the 23rd December, 1920, lamenting,—"It is much to be regretted that notwithstanding the ample ethnological material available in all direc-

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tions, our members as a body have not yet taken much practical interest in this branch of the Society's activities" (*Journal of the Bihar and Orissa Research Society* [1920], Vol. VI, p. 469).

Handbooks on Castes and Tribes.

It is refreshing to turn from this disheartening account of the comparative failure of scientific societies to organize bands of ethusiastic workers in Indian Ethnology, to another phase of anthropological work in India,—that of the compilation of systematic catalogues of the castes and tribes of each Province, and collecting and consolidating all available information about them whether occurring in published books, Reports and magazine-articles or in unpublished official records. The comparative success that has attended this branch of anthropological work in India appears to be due to the fact that it has been carried out at the instance and expense of Government and mostly by its own officers, and there was therefore no dearth either of funds or of workers. Such defects and inaccuracies as are found to exist in some of the Government publications on Castes and Tribes appear to be due to the fact that materials were sometimes taken, without verification, from reports called for from Police Darogas, School Sub-Inspectors and other subordinate officers or private individuals who did not possess either the necessary equipment for the investigation of the questions referred to them for inquiry nor the desire or the incentive to make careful and intelligent inquiries and to appreciate the significance of all the questions put and the answers elicited. Every regular field-worker in Anthropology will understand the risks of error that such a course necessarily involves.

The British Government was from the beginning alive to the administrative value of a knowledge in its officers of the economic condition, social organization, customs, habits and religion of the population placed under them. Thus, as early as the 7th January 1807, we find the Court of Directors of the Honourable East India Company writing to the Government of the Presidency of Bengal,—"We are of opinion that a statistical survey of the country under the immediate authority of your Presidency, would be attended with much utility; we therefore recommend proper steps to be taken for carrying the same into execution." The Court further directed that Dr. Francis Buchanan, who had been employed by the Marquis of Wellesley in the survey of Mysore, should be appointed for the Survey. Accordingly, Dr. Buchanan (afterwards Buchanan-Hamilton) was appointed by the Governor-General in Council with a monthly allowance of *sicca* rupees fifteen hundred exclusive of his usual pay and *batta*, and supplied with a staff of "efficient learned assistants, draftsmen, etc.," to carry through the work.

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In seven years, Dr. Buchanan could only complete the survey of the then districts of Bihar, Patna, Shahabad, Bhagalpur, Dinajpur, Gorakpur, Purnia, Rangpur and Assam. The materials thus collected in twenty-five folio volumes were forwarded to the home authorities in 1816. The volumes which have since remained in the India Office (formerly the East India House), are reported to contain among other things a mass of information regarding the manners, customs, religion, etc., of the inhabitants. But, unfortunately, much of the ethnographic material contained in these volumes have hitherto remained a sealed book, although three volumes of selections from these valuable Reports and Journals were published, in 1838, by Montgomery Martin under the title of "The History, Antiquities, Topography and Statistics of *Eastern India* comprising the districts of Behar, Shahabad, Bhagulpoor, Goruckpoor, Dinajpoor, Puraniya, Rungpoor and Assam, in relation to their Geology, Mineralogy, Botany, Agriculture, Commerce, Manufactures, Fine Arts, Population, Religion, Education, Statistics, etc." It is understood that the publication of the ethnographic material contained in Buchanan-Hamilton's Journals is now under the consideration of the Secretary of State for India.

The next attempt of this kind appears to have been made in 1820, by Walter Hamilton in his ambitious work entitled "A Geographical, Statistical and Historical Description of Hindostan and Adjacent Countries," which was prepared, as the author informs us, by collating all printed documents accessible to the public and all the manuscript records and Government Reports deposited in the archives of the India Board An attempt was made in the two volumes of this work to describe among other things, the castes and tribes inhabiting different parts of India. But how meagre was the information that Hamilton could glean from all these sources available to him, may be seen from only one illustration. Chota Nagpur, as every student of Indian Ethnology now knows, is the home of a number of aboriginal and semi-aboriginal tribes besides several Hindu castes. But all the information that Walter Hamilton could give us in 1820, was.—"The Khetauri, the Koeri, and the Dhanggar, are still the principal inhabitants of Chota Nagpur, where it is said that the latter, and probably also the former do not speak the Hindi language. The Dhanggar are still impure and probably unconverted Mlecchas" (p. 288). Apparently the name Dhanggar refers to the Oraons. Eight years later when the same author brought out in London the second edition of his other work "The East India Gazetteer," the only additional information that he could give about the Chota Nagpur tribes is the existence of many strange tribes of whom the author can name only two, namely, the Coles of Tamar (by which term apparently the Mundas are meant)

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and the Lurka Coles of Singbum (meaning the Hos). But of the customs and manners of these strange tribes next to nothing was yet known. The entire ethnological information about Chota Nagpur given in this second edition of the "East India Gazetteer" is contained in the following paragraph: "The impervious fastnesses here conceal many strange tribes, who even at this late era of Hindu predominance, have not yet become converts to the Brahminical doctrines, and are consequently classed by the priests among the abominable. The Khetauri, the Koeri, and the Dhanggar still compose the bulk of the inhabitants and some of these are said to speak the Hindi Language. The Dhanggar are still impure unconverted Mlechhas or barbarians. This territory contains a large proportion of Cole and Lurka Cole tribes, more especially in the pergunnah of Tamar and the tracts situated near the hills that separate it from Singbhoom, where there were disturbances in 1822. The Tamar female Coles possess some wearing apparel, but those of the Lurka Coles go entirely naked except a small piece of cloth. They appear to be Hindoos, but of the most degraded castes."

Thornton's "Gazetteer of the Territories under the East India Company" which appeared in four volumes in 1854, did not make any material addition to the then meagre knowledge of the people of India, although in the Preface to this book which was compiled under the authority of the Hon'ble Court of Directors of the East India Company, chiefly from documents in their possession, we are told,—'the present work is the first that ever aspired to the character of completeness as a Gazetteer of the territories under the Government of the East India Company and of the native States on the continent of India."

A more satisfactory attempt at preparing a general account of the people of India, based on all existing materials as well as personal observation and inquiry in several parts of India, was that by Mr. Justice Campbell of Calcutta. His essay of 152 pages on the "Ethnology of India" was published in 1866 as a supplementary number of the Journal of the Asiatic Society of Bengal. The paper was designed, as the author stated, "to assist both Government officials and private persons in making classified and descriptive lists in such a uniform manner and with such a uniform nomenclature and arrangement, that it may be afterwards possible to weld together the whole of the information thus obtained." The author hoped that such an 'ethnological skeleton' might serve as a guide and model into which the various details collected by future investigators might be fitted. Mr. Justice Campbell frankly characterizes his paper as "an avowedly imperfect sketch, designed to elicit the information which may afterwards render possible something more complete." This modest attitude is in agreeable

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contrast to the tone of the contemporary eminent English ethnologist, Dr. R. G. Latham, then Vice-President of the Ethnological Society of London, who, in 1859, published his "Ethnology of India" in 375 pages. This was an extract from his two-volume work, "Descriptive Ethnology," in which he claims to have attempted "a full and systematic description of the several varieties of mankind." Unlike Campbell, Latham, who apparently had not the advantage of a personal knowledge of India and her peoples, was misled into asserting as yearly as 1859,—"Of no country is the ethnological literature more valuable, full and reliable than that of British India." And "the Nilgherry Hills," he tells us, "are the parts which have been best investigated." All the information, however, which Dr. Latham could give us of the tribes of these hills is contained in the following few lines: "They (the Nilgherry Hills) give us :—

The Tudas—Infanticide polyandrists, who are few in number, and less Hindu than their neighbours;
The Curumbars, Curumars, or Curbs;
The Irular—(compare the name Warali); and
The Budugars—all fragmentary, pagan, and semipagan populations. In the Tuda creed the black stone has a prominent place. The fuller form of the word is Tudava, apparently word for word "Tulava" (pp. 358–359)."

With greater discrimination born of some personal knowledge, Mr. Justice Campbell says of the Todas,—"They are not properly Hindus, but no one who has seen them would for a moment suppose that they belong to the Negrito races. They are evidently Caucasians of a high type. In truth they are but a very small tribe; the common tradition and consent of the country makes it clear that they came as conquering immigrants to their present position at a comparatively recent period and their pastoral habit renders their migration more easy. Their language so small a body may well have almost lost during their wanderings among Dravidians" (pp. 24–25). It is interesting to note that in the latest authoritative work on the *Todas*, Dr. Rivers suggests that the Todas may have been derived from ancient immigrants from the south, either Aryan Nambuthiri Brahmans or the strongly Aryanised Nairs who are so largely of Nambuthiri blood (p. 709). Of the other Nilgiri tribes Campbell writes, (pp. 30–31), "There seems to be some doubt whether the Badagars and Kotas of the Lower Neilgherry hills are properly Aborigines, they being, it appears, immigrants in those parts, and Carambars the true aborigines. I have not been able to meet with any very connected or detailed account of the thoroughly Aboriginal tribes of the hills and forests of the Nilgherries, Pulneys, and Western Ghats. The

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word *Maleasur* seems to mean simply a hill man, and the more proper tribal designations appear to be Carambers, Irulars, Puliars, and Veders. These seem to be tribes in the very lowest stage of savageness, with in fact scarcely any agriculture, mere men of the woods. They are represented as of very diminutive stature, with thickly matted locks and supple limbs, living under trees or caverns, keeping sheep or collecting forest produce, very stupid but also very mild and inoffensive, except that they have a great reputation as sorcerers, and themselves believing in a religion of demons and witchcraft, are by their neighbours believed to be highly gifted that way, although they seem to be very inferior to the simple but sturdy and industrious Coolees of the North" (pp. 30–31). To us, with our present better knowledge of the southern hill tribes, it would appear that here the writer confuses the characteristics of different tribes,—of the black Irulas and the better-looking and more well-to-do Badagas who are both agriculturists of the Nilgiri hills, the full-bearded, well-proportioned, aquiline-nosed, light-coloured Todas who are the pastoral tribe of those hills, the carrion-eating Kotas who form the artisan class, and the wild miserable-looking Kurumbas with their matted hair who are the sorcerers and wizards of the Nilgiri hills, the Pulayans who are the agrestic serfs of Malabar and the short primitive Vadars or Mala (hill) Vedans of Travancore who file their teeth and kindle fire by friction and who are supposed by some to be identical in race with the Veddas of Ceylon.

In the opening lines of his paper, Campbell informs us that "the great subject of Indian Ethnology has been taken up by the Asiatic Society of Bengal in a serious and earnest manner, with a view to that actual observation and practical inquiry which is only possible in the countries and on the spots where the various races are found, or where specimens of them may be collected together"; and that "the Government has already consented to take the first step in aid of the movement by collecting from its officers, in all parts of India, lists of the races and classes existing in the various districts." In compliance with a requisition from Government to all the Commissioners of Divisions to furnish lists of the various tribes and castes found within their respective jurisdictions, some descriptive lists were prepared and submitted to Government. And, in 1869, the Government of Bengal selected Colonel Dalton, to edit the ethnological information thus obtained. Dalton, however, offered to prepare a descriptive account of the tribes of Bengal and Assam, not only from the materials thus obtained but also by collating all available sources of information such as official reports, journals of learned societies, and other publications. The Asiatic Society of Bengal tendered their services to Government to superintend the printing of the work, and the Government which undertoook the publication of the work thankfully accepted the

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offer And in the splendid quarto volume of Dalton's "Descriptive Ethnology of Bengal" published in 1872, we have the first authentic descriptive account of the hill-tribes of Bengal, Bihar, Chota Nagpur, Orissa and Assam.

Although, as a result of subsequent investigation, we are now in possession of a quantity of additional information about some of the Assam and Chota Nagpur tribes, and, in the light of such knowledge, we can point our finger at occasional inaccuracies and shortcomings in his descriptions, Dalton's will always remain the most valuable pioneer account of those hill-tribes.

The decade that followed the publication of Dalton's "Descriptive Ethnology" was a period of increasing Government activity in the collection of statistical and other data relating to the various provinces of India. The Census Reports, Statistical Accounts, District Manuals and Gazetteers, Settlement Reports, Reports of the Linguistic Survey of India, and even the Archæological Survey Reports published under Government authority during this period supplied a mass of incidental information relating to the castes and tribes of India. But the information thus incidentally collected could be neither accurate nor exhaustive. And in September, 1882, the Government of India at the instance of the Census Committee issued a circular to all Provincial Governments and Administrations, suggesting that "steps should be taken on the basis of the statistics recorded in the Census of 1881 towards collecting more precise information than at present exists regarding the castes and descriptions of the people of India." Accordingly, in February 1885, Mr. (afterward Sir Herbert) Risley was selected by the Bengal Government to collect detailed information of the castes, tribes and sociology of the Province. And later, Dr. William Crooke was selected by the Government of the North-Western Provinces (now the United Provinces of Agra and Oudh) for similar work in that Province. In May, 1901, the Government of India formally sanctioned the scheme for a systematic and detailed ethnographic survey of Madras, Bombay, Bengal, the North-Western Provinces of Agra and Oudh, the Punjab, Central Provinces, the Central India Agency, Assam and Burma, and a Superintendent of Ethnography was appointed to each Province to carry out the work of the Survey, of which Risley was appointed Honorary Director. Thurston was appointed Superintendent of Survey for the Madras Presidency, Russel for the Central Provinces, Captain C. E. Luard for the Central India Agency, Enthoven for the Bombay Presidency, Rose for the Punjab, and, later, Denys Bray for Beluchistan. The enquiries were to be conducted on the lines of certain questions drawn up by Nesfield, Ibbetson and Risley at a conference held in 1885. To this Survey we owe the four volumes of the Tribes and Castes of Bengal by Risley, first

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published in 1891, the four volumes of the Tribes and Castes of the North-Western Provinces of Agra and Oudh by Dr. Crooke, published in 1896, the six volumes of Castes and Tribes of Southern India published by Thurston with the assistance of Mr. K. Rangachari, published in 1909, Rose's "Glossary for the Tribes and Castes of the Punjab and North-Western Frontier Provinces" published in 1911, Captain C. E. Luard's "Ethnographical Survey of the Central India Agency" (1909), and the four excellent volumes on the Castes and Tribes of the Central Provinces compiled by Russel with the assistance of Rai Bahadur Hira Lall and published in 1915. The Bombay Superintendent issued, since 1903, certain draft articles styled "Monographs," but a consolidated hand-book of the Castes and Tribes of that Presidency does not appear to have been yet published. Similar ethnographic surveys were also undertaken by a few of the Native States, such as Mysore, Cochin and Trávancore: and, as a result, we have such accounts as Mr. H. V. Nanjundayaya's bulletins of the Mysore Castes and Tribes, and the two sumptuous volumes on the Cochin Tribes and Castes by Mr. L. K. Anantha Krishna Iyer.

In the compilation of these volumes on the Castes and Tribes of the different provinces, free use was made of the mass of information which lay buried not only in official reports and in the Journals of learned Societies, but in various other interesting books published up till then. Among the authors of such books, too, Indian names are conspicuous by their absence.

Through information contained in all such books, the fuller information contained in the numerous ethnographic articles in the journals and magazines already mentioned, the ethnographic information contained in various Government Reports and Gazetteers, and, above all, the volumes on Castes and Tribes prepared by the Ethnographic Survey of India, we have now come to possess a general outline view of the numerous castes and tribes inhabiting the country and the different physical and cultural types that make up the present Indian population. Even the different tribes and castes of those parts of India that were, not many years ago, ethnologically almost *terra incognita* to us, are now, in their broad outlines, pretty familiar to students of Anthropology through the labours of the Ethnographical Survey. Thus, to take one instance, most of the wild tribes that inhabit the secluded hills and jungles of the Cochin State are to us no longer the vague entities that they were to an earlier generation of ethnologists. All the information that Latham (*Ethnology of India*, p. 359) could give us of these tribes in 1859, was that they were known as the "Malearasurs" and were "analogous to the Tudas, etc., in the hills of the Malayalam country." Eight years later, Mr. Justice Campbell (*Ethnology of India*, pp. 30–31), could only say, "Allusions seem to be made to the existence of Aboriginal or quasi-Aborginal

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tribes at different points in the Western Ghats and Coasts; the names of 'Chermars' and 'Neade' are mentioned in Travancore and Cochin, but they are no doubt the same as Cherniers and Nagadees, the slaves of Malabar. The Dhers and Ramooses of the centre and west of the Peninsula seem to be mixed up with the general population. On all these points more precise information is much required. It is not till we cross the Godavery to the north, that we come to the country really held by the Aborigines" (p. 31). But thanks to the Ethnographic Survey of the Cochin State, ethnologists are to-day almost as familiar with the aboriginal tribes of the Cochin hills and jungles as they are with the tribes living north of the Godavari,—namely, the various tribes of the northern hills from the Aka, the Daffla, the Miri, the Abor, the Mishmi, the Singhpo, the Khamti, the Naga, the Mikir, the Kuki, the Lushai, the Garo, the Khasi, the Kachari, and the Meithie of Assam, to the Bhotiya, the Lepcha, the Champa, the Ladakhi, the Balti, the Dard, the Pahari, the Dogra, the Tharu, the Bogsha, the Naga and the Khasa or Khasia, of the central and Western Himalayan and Sub-Himalayan regions; and the Baloch, the Brahui, the Kafir, the Waziri, the Afridi, the Swatee, the Mommand, and other Trans-Indus tribes further to the north-west; and then the numerous tribes of the highlands and hills to the south of the Gangetic plains from the Juang, the Savara, the Banjara, the Bendkar and the Bhuiya of the Orissa hills on the east, the Oraon, the Munda, the Ho, the Bhumij, the Birhor, the Korwa, the Kharia, the Pahira, the Asur, and the Birjia, besides other minor tribes of the Chota Nagpur plateaux; the Santal, the Mal Paharia and the Sauria Paharia of the Santal Parganas; the Gond, the Khond, the Parja, the Gadava, the Korku, the Kisan, the Kawar, and the lesser tribes of the Central Provinces, to the Bhil and the Koli extending as far west as Guzerat, the home of the stalwart and turbulent Gujars.

These volumes on the Castes and Tribes of the different Provinces are, however, mere general and superficial surveys that fail to furnish that detailed exposition of kinship organization and social system, primitive ideas, usages and customs, religious beliefs and ritual, superstitions and folklore, which is needed for the purpose of scientific anthropology. As descriptive catalogues—or 'Ethnographic Glossaries,' as their authors appropriately designate them,—they may well serve as useful bases for more intensive studies of the various interesting individual castes and tribes But without such intensive studies of the different tribes and castes by careful students of Ethnology, we shall look in vain for adequate materials for science. An exhaustive collection of more complete and better sifted facts than we now possess, capable of being scientifically treated—of being properly classified and viewed in their mutual

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relations for purposes of the generalizations of Science,—is still a crying desideratum in Indian Ethnography.

Ethnographical Monographs.

In one Indian Province alone, the value of such intensive studies appears to have been recognized. In 1903, Sir Bampfylde Fuller, then Chief Commissioner of Assam, proposed and received the sanction of the Government of India for the preparation of a series of monographs on the more important tribes and castes of that Province. Sir Bampfylde laid down a scheme in accordance with which each monograph was to deal with the habitat, economic and domestic life, tribal and social organization, laws and institutions, religion and folklore, language, racial affinities, and traditions as to the origin of the people concerned. Major Gurdon who was appointed Superintendent of Ethnography and, later, Honorary Director of Ethnography for Assam, edited the series of excellent monographs beginning with his own book on the 'Khasis' (first published in 1906) which has now passed through a second and enlarged edition (1914) and followed by similar books on the 'Meithies' (1918) by T. C. Hodson, the 'Mikirs' (1908) by Edward Stack, the 'Garos' (1909) by Major Playfair, the 'Kacharis' (1911) by Rev. S. Endle, the 'Lushai Kuki Clans' (1911) by Lt.-Col. J. Shakespeare, and the 'Naga Tribes' of Manipur (1911) by T. C. Hodson. Other books of the series are reported to be under preparation. So far as this intensive form of ethnographic study is concerned, it has unfortunately as yet attracted but few Indian workers. Indeed, with the exception perhaps of monographs on a couple of Chota Nagpur tribes there is hardly any other work of the kind from the pen of an Indian.

Again, there is another important branch of anthropological investigation which has been left severely alone not only by Indian students but even by most European investigators of man in India. I refer to what is known as Prehistoric Archaeology but what may not inappropriately be as well named Prehistoric Anthropology,—for, this is our only source of direct knowledge of Prehistoric man and his culture. Practically all the slender knowledge that we now possess of Indian Pre-history is mainly derived from the scanty accidental finds of a few Europeans, mostly members of the Geological Survey of India. How meagre is our knowledge of prehistoric man in India may be judged from the fact that though a number of ancient stone implements and other prehistoric artefacts have been picked up in various parts of India—in Chota Nagpur, the Central Provinces, the Central India Agency and Rajputana, Guzerat, the United Provinces, in the valleys of the Godavari and the Narmada, and in various districts of the Madras Presidency,—no undoubted fossil human remains have yet been discovered in association with Indian palaeoliths, and only in

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two authentic instances in India have palaeoliths been discovered in direct association with the fossil bones of extinct animals —namely, in the cases of Wynne's Mungi flake and Haeckett's Bhuttra boucher, discovered one in the ossiferous gravels of the Godavari Valley in 1861, and the other in similar gravels of the Narmada Valley in 1873. There are, however, good reasons to expect that systematic search for and regular stratigraphical study of the skeletal and industrial remains of prehistoric man in India may yield most important results towards the elucidation of the Pre-history of man, from the Late and Early Iron Ages through the Copper Age and New Stone Age back to the Palaeolithic and Perhaps Pre-Palaeolithic times. For the present, A. C Logan's "Old Chipped Stones of India" (1906), Bruce-Foote's "Indian Pre-historic and Proto-historic Antiquities" (1914–16), Coggin-Brown's "Catalogue of Pre-historic Antiquities in the Indian Museum" (1917) besides a few articles in the Records of the Geological Survey of India, and in the journals of the Asiatic Society of Bengal and of the Bihar and Orissa Research Society, and in one or two other journals constitute about all the meagre Indian literature on the subject.

As for the artistic remains of Prehistoric man in India, a few rude paintings generally of animals or hunting scenes or symbolic drawings on the walls of certain cave-shelters in the Mirzapur District in the United Provinces, at Singanpur in the Raigarh State of the Central Provinces and at Edakkal in the Bellary District (Madras) are about the only specimens hitherto known. And even of these their antiquity has not yet been sufficiently investigated. And the same is the case with Indian megalithic monuments,—the menhirs and dolmens of the Khasi Hills, Chota Nagpur Plateaux and elsewhere, and the cromlechs and kistavens scattered over the hills and plateaux of Southern India. Thus, then, we necessarily lack adequate materials for investigation into the origin, variety and characteristics of the prehistoric races of India, their early migrations and their relation to the existing races, and our present knowledge on these points is as yet next to nothing. Finally, the essentially scientific work of tracing the racial and cultural affinities of the different existing castes and tribes of India and reconstructing their ethnic and cultural history can hardly be said to have yet begun. In fact, much fuller accounts of the history and traditions and physical and cultural, including psychological, characteristics than we now possess of each individual caste and tribe are required to enable the ethnologist to trace the ramifications and distribution of particular cultural features and industrial and artistic products, to unravel the tangled skein of the diverse race-elements and culture-elements associated together in any particular ethnic or cultural groups, and thereby to trace the group's racial affinities and reconstruct its

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cultural history. It goes without saying that before we can properly systematize our facts and attempt to explain their scientific relation, we must possess as exhaustive a collection of such facts as possible.

Thus, with our present superficial knowledge of the ethnography of the different tribes and castes of India, neither the theory of the racial affinities of the different groups of the people of India put forward by Risley in his "People of India" (1st edition, 1908; 2nd edition, 1915) nor the later and perhaps more plausible view of Mr. Rama Prasad Chanda set forth in his "Indo-Aryan Race" (1916) can be confidently accepted as the last word on the subject. Again, such knotty questions as the Brahui-Dravidian problem, the Mon-Khmer-Ho-Munda-Khasi problem, the problem of the Copper-Age and the Stone-Age men of India are yet as far from any approach towards definite solution as ever. And here, as in other matters, it is mainly to European scholars such as Kuhn, Schmidt, Grierson (*Linguistic Survey of India*), Risley (*People of India*), Holdich (*Gates of India*), Logan (*Old Chipped Stones*), and others that we owe such attempts at the solution of these problems as have been hitherto made. So far as Indian Anthropometry is concerned, if we except the work of one or two European scholars, it is to the labours of the Ethnographic Survey of India that we practically owe all the work hitherto done in this direction. But the measurements taken by the Survey were neither as extensive nor as thorough as might be desired. The old method of averages which was followed fails to represent the differences of types in a group. In fact, the new science of Biometry which seeks to find out the mean of the anthropometric measurements of a group by co-ordination and seriation and study the extent and frequency of deviations from the mean by plotting out binomial curves of the indices, had not yet been sufficiently developed to be applied to the investigations of Physical Anthropology.

It is Dr. Annandale who only recently first applied the biometric method to various measurements taken by him at Calcutta; and Prof. P. Mahalanobis is, I understand, now working up his results.

Thus, then, almost the whole of the present anthropological literature relating to India is the result of the labours of European investigators—mostly hard-worked officers of Government and Christian Missionaries, and to them India shall ever owe a heavy debt of gratitude for this invaluable pioneer work. As for us Indians notwithstanding our better advantages for such investigation, we have unfortunately stood by in apathetic indolence, while all the while much valuable material for study has been fast disappearing.

Throughout this paper I have laid particular stress on the neglect of anthropological research by educated Indians. If,

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however, we, Indians, have hitherto taken only an insignificant part in anthropological research, the blame cannot be entirely laid at our door. At least a portion of the responsibility for such neglect may be fairly fastened on other parties.

There are, first, the different Universities of India. Until quite recently did they do anything to encourage the study of Anthropology ? Far from encouraging such study, they did not even recognize it as a subject of University education. It is only within the last three or four years that a few Indian Universities have awakened to the importance of the science. The Patna University under the guidance of its first Chancellor, the accomplished Ethnologist Sir Edward Gait, led the way by introducing Ethnology as one of the subjects for its Degree examinations. But whereas the Patna University has unfortunately stopped with the creation of a bare Readership and has not yet made any arrangements for imparting regular instruction in the subject, the premier University of Calcutta, under the guidance of the Hon'ble Justice Sir Ashutosh Mukerji, has since enthusiastically taken up the subject and made elaborate arrangements for instruction in its different branches by appointing four or five permanent Lecturers besides occasional Readers in Anthropology. The Bombay, Madras, and Mysore Universities are also making some arrangements for teaching Sociology and Ethnology. Till now, however, it is in Calcutta alone that the establishment of a School of Anthropology with an Ethnological Museum and a good anthropological Library is an accomplished fact ; and it makes the heart of an anthropologist throb with delight to see an enthusiastic band of promising students eagerly availing themselves of the facilities for study provided in this School by the authorities of the Calcutta University. Only a couple of years ago, however, very few anthropological books and journals could be found on the shelves of our college libraries in India. And even to-day, as we have seen, it is only a very few Universities in this country that have seriously undertaken to make some sort of a provision for anthropological study and instruction. What a sad contrast this to the zealous efforts of European and American Universities for over a quarter of a century now for the promotion of Anthropological study and research ! Thus, to mention one or two instances : the Oxford University took up Anthropology as a serious study in 1884, and the Cambridge University in 1893. Unlike our Indian Universities, they did not consider their duty done by merely creating Readerships and Professorships in Anthropology and admitting it as a subject for Degree examinations. They have further been vigorously organizing or otherwise promoting anthropological research through their Professors and other experts and training their students in field work. Thus, it was under the auspices of the Cambridge University that the famous

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expedition to the Torres Straits was undertaken, and, as a result of the expedition, we possess the invaluable volumes on the anthropology of that region, up till then very imperfectly known to science. Whereas these foreign Universities have enthusiastically fitted out expeditions to distant lands for anthropological study and research, our own Universities have hitherto remained lamentably indifferent even to the unbounded field for anthropological investigation lying at their very door. Again, whereas very few of our Universities have thought fit to approach the Imperial or Provincial Governments for aid in the promotion of Anthropological study, we find in 1909, a joint deputation from both the Universities of Oxford and Cambridge representing to the Secretary of State for India and to the Secretary of State for the Colonies the need for the training of Indian and Colonial Civil Service candidates and probationers, in ethnology and primitive religion.

This brings me to a consideration of the insignificant part hitherto taken by the Government of India and our Provincial Governments in promoting anthropological research. Important as has been the work of the general ethnographic surveys of the different provinces initiated by the Imperial Government and enthusiastically carried through by the Provincial Governments and administrations, these surveys undertaken for the needs of the practical administrator have not directly aided the promotion of independent scientific research. The action of various local Governments in making grants for anthropological research to learned societies such as the Asiatic Society of Bengal, the Bihar and Orissa Research Society and the Anthropological Society of Bombay have indeed been of greater help in this direction. But without the co-operation of a body of educated persons taking a practical interest in such work, these societies cannot be expected to accomplish much. And even in this respect, our Governments in India have been far less liberal than, for example, the Government of the United States which makes an annual grant of £8,000, a year to the Smithsonian Institution for researches in North American Anthropology. The great desideratum in India is, indeed, to raise a band of enthusiastic and trained workers in the country ; but this can only be done by promoting the study of Anthropology in the different Universities through liberal Government aid in the foundation of Chairs, Readerships, and Lecturerships and a number of research scholarships in Anthropology, as also in the recognition of anthropological knowledge as a necessary equipment for the Judicial and Executive officers of Government.

It is too late in the day to ignore the great administrative value of a knowledge of Anthropology in all officers engaged in administrative work. The sympathy born of an intelligent

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appreciation of the customs, habits, and mentality of the tribes and castes that an officer or even a business man has to deal with, is ordinarily a sure guarantee for successful work. A few years ago, the Sudan Government marked its recognition of this truth by directing that every candidate for its services must go through a course of Anthropology at Oxford or Cambridge. And it is high time that in India a similar rule should be enforced in the case of candidates for the Indian Civil Service, and that our Provincial Governments, in the selection of members for their Provincial and Subordinate Civil Services, should give preference to candidates holding degrees in Anthropology in an Indian or foreign University. This will not only improve the quality of administrative work, but will afford a strong incentive for the study and advancement of the Science. Executive and Judicial Officers thus trained in Anthropology will in the course of their daily work have ample opportunities for ethnographical observation and inquiry. And the recorded results of such observation and inquiry by officers, thus trained, may be expected to advance to some extent the cause of anthropological research.

If the Universities and the Government have not hitherto done all that they could and should have done to help forward Anthropological research in the country, the millionaires of our country—our landed aristocracy, merchant-princes, and professional magnates—have been still more apathetic to the claims of this 'Queen of Sciences' In Europe and America, anthropological research owes much to the liberal patronage of the wealthy. Thus, to take only one or two instances, the Selenka-Trinil expedition to Java to search for the remains of *Pithecanthropus Erectus* and the Trinil race was fitted out in 1907 by Frau Lenore Selenka at an enormous expense. And with the aid of the Percy Sladen Trust Fund, another anthropological expedition was organized under Dr. Rivers for the study of the ethnology of the Oceanic peoples. Again, in the London University, a Chair of Sociology, and a Lecturership in Ethnology which has since developed into a Professorship, were both established in 1904 by the generosity of a private gentleman. In the name of Indian students of the Science, I would now earnestly appeal to all wealthy patrons of learning in India to emulate their brethren in the West and open their purse-strings with similar liberality to advance the cause of anthropological research, and thus help to remove a long-standing reproach against Indian scholarship.

Lastly, I would earnestly appeal to all Indian students who feel attracted to this fascinating branch of study, to master it with assiduity, stick to it through life—through good fortune or evil, apply themselves whole heartedly to the interesting anthropological material abundantly scattered all around them, but—alas !—fast slipping away as the days pass by. I venture

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to assure them from my own humble experience that such a study will bring with it in the shape, at any rate, of personal satisfaction and delight, an adequate reward for the time spent and trouble taken. Every earnest student of the science will, I doubt not, realise in his own experience the truth and force of what Sir Richard Temple said of Anthropology :—

" There is hardly any better hobby in existence than this, or one that can be ridden with greater pleasure. It cannot, of course, be mastered in a day. At first the lessons will be a grind. Then, until they are well learnt, they are irksome, but when fullness of knowledge and maturity of judgment are attained, there is, perhaps, no keener sense of satisfaction which human beings can experience than that which is afforded by its study. Its range is so wide, its phases so very many, the interests involved in it so various, that it cannot fail to pleasantly occupy the leisure hours from youth to full manhood, and to be a solace, in some aspect or other, in advanced life and old age."

It is not, however, merely the mental satisfaction to the individual student, that anthropological study and investigation will bring with it in India. Such investigation, properly pursued, will remove a standing reproach against educated Indians ; and its results are expected to prove a great gain to the Indian nation and to the scientific world at large. If we do not shirk the inevitable initial grind and drudgery, but diligently acquire the necessary equipment for anthropological research, patiently pursue the preliminary spade-work with the same enthusiastic devotion and perseverance that characterize students of the Science in the West, abjure all unscientific bias and abstain from rushing into hasty conclusions and premature generalizations from inadequate and unsifted data, we may expect to found, in time, a sober well-equipped Indian School of Anthropology to which the scientific world will look for a correct interpretation of the evolution of Indian man—his racial affinities, mentality and culture. For, such a school may very well be expected to interpret these with more intimate knowledge and better insight and consequently with a greater approach to scientific accuracy than foreign investigators, however assiduous and sympathetic, can ever hope to attain. And thus, and thus alone, will Indian scholarship be enabled, in the fullness of time, to bring its own peculiar and invaluable contributions to Anthropology as it brought in the remote past to Philology, Philosophy and Metaphysics, as it has brought in our own days to Physics, Chemistry and Mathematics and as it is expected to bring in the not very distant future to other sciences as well.

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Human Sacrifices.—*By* Rai Bahadur Hira Lal.

(1) Universal prevalence of human sacrifices and its continuance in certain places quoted from Police Reports.
(2) Various forms of human sacrifices, viz.:—cutting by throat, drowning, burning, burial, throwing down from precipices, crushing under cars, trampling by cattle or killing by noose with examples.
(3) Substitutes for human sacrifices such as cocoanuts, pumpkins, curds, rice and flour with a lamp.
(4) Exemptees from human sacrifices—Females, Brahmans, etc.

The Indian megaliths—their origin and chronology.—*By* Panchanan Mitra.

Prof. Elliot Smith now practically holds the field with his theory of the origins of the megalithic cult in protodynastic Egypt and dispersal thence all over the world. The old studies of Walhouse and Fergusson who had first-hand knowledge of Indian megaliths resulted in premising an Western influence. The recent studies of Mr. Longhurst also point to an Egyptian-like culture which produced the countless megaliths in the Deccan. The recent excavation of Asura rites in Ranchi by Rai Bahadur S. C. Roy turn our attention to the references in Satapatha Brahmana (c. 18th century B.C.) and Dr. Block after laying bare some mounds at Lauriya Nandangargh in Behar had hinted at their possible antiquity and representation of Vedic rituals. While the existence of similar maunds in Central Asia and further north from Pumpelly and Micrus lead to supposing existence of a separate mound-cult in that region and dispersal therefrom, the variety of Indian megaliths, its distribution in larger numbers near the Southern seaboard and its survival amongst the tribes of pre-Dravidian tracts in India indicate that this was probably the result of an Indo-Erythraean culture-complex beginning in times contemporaneous with pre-dynastic and proto-dynastic Egypt and continuing up to the days of Dravidian domination when prehistoric India was in intimate cultural contract with Egypt and possibly Central Asia roughly calculated as between 300 and 1000 (*t* 200) B.C.

The thunderweapon in Eastern art and religion.—*By* N. G. Majumdar.

The paper gives an account of the various forms of the thunderweapon prevalent in Eastern art and at the same time touches upon the cult or cults connected therewith. An attempt has been made to prove that Śiva was originally a god of thunder and three of his characteristic marks, viz. the bull, the trident and the axe were borrowed from the representation of Adad in Western Asian Art. The author also discusses the worship of thunder-symbols in ancient and modern India and gives illustrations from the Lamaic art of Tibet.

Prehistoric antiquities from Ghatsila.—*By* Panchanan Mitra.

Report of the finds of a huge Palaeolith from a river-terrace as well as of a small neolithic axe and a rock-carving near by possibly of neolithic date with marked Australian affinities.

The statistical constants of an Anglo-Indian sample: Part II:—Head length and head breadth.—*By* P. C. Mahalanobis.

The first part, on stature, was read before the Asiatic Society in November, 1920. The measurements were carried out in the Anthropo-

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logical Laboratory of the Indian Museum. In this paper the Frequency Constants of Head Length and Head Breadth are calculated. The question of statistical homogeneity is next discussed with special reference to variability of known homogeneous material.

Animistic elements of Jainism.—*By* PRABODHCHANDRA BAGCHI.

The paper deals with the historical beginnings of Jainism and its attitude towards the privileged classes shortly. It explains further how the incorporation of the religious beliefs of the people of lower culture became possible in Jainism.

Next it traces the animistic elements in Jaina philosophy, in Jaina rites and superstitions and lastly in Jaina mythology.

It concludes with a few words regarding the existence of similar elements in other popular systems of Indian Religions.

Folk-elements in the marriage ceremony as practised by some Hindu castes of Bengal.—*By* TARAK CHANDRA DAS.

The article aims to give a correct description of the various popular elements which are found existing side by side with the Shāstric ceremonies in a Hindu marriage ceremony. An attempt also will be made to trace their origin and the environment which helped their growth, in the light of Anthropology.

Primitive background of the early Buddhism.—*By* RAMAPRASAD CHANDA.

The railing of Bharhut an illustrated manual of early Buddhism. The Yakṣas and the Nāgas. Tree and mound worship, origins of these cults, cradle-land of Buddhism, ethnic affinities of the population of the cradle-land of Buddhism.

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Proceedings of the Ordinary General Meetings, 1921.

JANUARY, 1921.

The Monthly General Meeting of the Society was held on Wednesday, the 5th January, 1921, at 9-15 P.M.

J. van Manen, Esq., in the chair.

The following members were present :—

Mr. W. E. Andrews, Mr. Ramaprasad Chanda, Mr. K. N. Dikshit, Mr. F. Doxey, Mr. Ivanow, Dr. S. W. Kemp, Mr. Panchanan Mitra and Mr. H. C. Roy-Chaudhuri.

Visitor :— Mr. Nirmal Kanta Bagchi.

The minutes of the last meeting were read and confirmed.

Nine presentations were announced.

The President announced that Dr. S. K Banerji had resumed the office of Physical Science Secretary from Dr. G. E. Pilgrim.

The General Secretary reported the death of Babu Roormall Goenka, an ordinary member of the Society.

The General Secretary reported that Mr. C. A. Silberrad, I.C.S., had expressed a desire to withdraw from the Society.

The following gentlemen were balloted for and elected as Associate members :—

Mahamahopadhyaya Vindyesvariprosad Dube.

Professor Shahay Ram Bose.

The following gentlemen were balloted for and elected as Ordinary members :—

Maharaja Jagadish Nath Roy, Maharaja of Dinajpur, proposed by Mr. N. G. Majumdar, seconded by Dr. R. C. Majumdar ; (2) *Murari Sharan Mangalik*, Esq., B.A., Editor "The Lalita," Seva Sadan, Meerut, proposed by Mr. Narendra Nath Law, seconded by Mr. Satya Charan Law.

The following papers were read :—

Further notes on Gypsies in Persia.—By W. Ivanow.

This paper has been published in the Journal.

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The beginning of the Yaksa Cult in India.—*By* RAMAPRASAD CHANDA.

The President announced that there would be no meeting of the Medical Section during the month.

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FEBRUARY, 1921.

The Monthly General Meeting of the Society was held on Wednesday, the 2nd February, 1921, at 9-15 P.M.

The General Secretary reported the death of Sir Charles Lyall, K.C.S.I., an Honorary Fellow of the Society.

The General Secretary also reported that the names of the following gentlemen had been added to the Building Committee :—

Dr. S. W. Kemp, Dr. W. A. K. Christie, Sir R. N. Mukerjee and Mahamahopadhyaya Haraprasad Shastri.

The President announced that Dr. U. N. Brahmachari had been appointed to act as Medical Secretary in the place of Major R. Knowles, I.M.S. on leave for eight months.

The President also announced that at a meeting of the Fellows of the Society held on Thursday, 6th January, 1921, the question of certain additions to the regulations for election of Fellows was brought up for consideration, and it was resolved as follows :—

(1) That in Rule 2A, the following words be added at the end of the first sentence :—

"one at least of whom shall certify that he is personally acquainted with the scientific or literary work of the candidates he proposes and is in a position from his own knowledge to express an opinion on its value."

(2) That the following be added as Rule 2B.

"Any candidate who canvasses for support in his candidature shall be disqualified for election."

The following gentlemen were balloted for and elected as Ordinary members :—

(1) *Lieut.-Col. Geo. S. Ranking*, M.A., M.D., C.M.G., University Lecturer in Persian, U.S. Club, Calcutta, proposed by the Hon. Justice Sir Ashutosh Mookerjee, Kt., seconded by Dr. D. R. Bhandarkar; (2) *Mr. Ramprasad Mookerjee*, M.A., B.L., University Lecturer, and Vakil, High Court, 77, Russa Road North, Bhowanipur, Calcutta, proposed by the

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Hon. Justice Sir Asutosh Mookerjee, Kt., seconded by Dr. D. R. Bhandarkar: (3) *Mr. Khagendra Bhusan Roy*, M.A., B.L., Zemindar of Narail, 6/3, Ramdhone Mitter Lane, Calcutta, proposed by Mr. Harit Krishna Deb, seconded by Mr S. N. Ghose; (4) *Mr. Subodhchandra Mookerjee*, Asst. Auditor, E.B. Ry., 97/2, Musjidbari Street, Calcutta, proposed by Mr. Harit Krishna Deb, seconded by Mr. Satyendra Nath Basu; (5) *Mr. Chhotelall Jain*, Merchant, 53/1, Burtolla Street, Calcutta, proposed by Kumar Devendra Prosad Jain, seconded by Mr. Padamraj Jain: (6) *Mr. Gopi Nath Sinha*, M.R.A.S., Zemindar and Rais, Bareilly, U.P., proposed by Dr. Munnu Lall, seconded by Mr. Ray Jatindra Nath Chaudhury; (7) *Lieut.-Col. J. W. D. Megaw*, I.M.S., Director, Calcutta School of Tropical Medicine and Hygiene, proposed by Dr. U. N. Brahmachari, seconded by Mr. A. H. Harley.

The following gentleman was proposed by the Council and elected an Honorary Fellow:—

F. W. Thomas, Ph.D., Librarian, India Office, London.

The President drew attention to the following exhibits:—

1. Seven Manuscripts:—Dr. A. Suhrawardy.
   (1) Qur'ān Sharīf (Asiatic Society's Collection)—written in the developed form of the Kūfī character.
   (2) Qur'ān Sharīf,—comprising thirty folios, each folio containing one section (para.).
   (3) Bādshāh Nāma.
   (4) Shāh Nāma.
   (5) Kulliyāt-i-Jāmī (Government Collection).
   (6) Qur'ān Sharīf, once in the possession of 'Abdur'-Rahīm Khān-Khānān.
   (7) An illustrated copy of Sikandar Nāma.

2. Painting on glass of the Old Kangra School from the Punjab:—Dr. Baini Prashad.

3. (1) Bhita and Central Asia Collections.
   (2) Some recently identified Gandhara Sculptures.
   Both exhibited by A. Foucher.

4. (1) Four plate works, with coloured plates of interest:—
   (*a*) William Hodges: Select Views in India. London, 1786.
   (*b*) Gustav Schmoranz: Old Oriental gilt and enamelled glass vessels. London, 1899.
   (*c*) Julius Lessing: Ancient Oriental Carpet Patterns London, 1879.

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(*d*) A van le Coq : Chotcho—Turfan Expedition. Berlin, 1913.

(2) A small silver Tibetan statue of Tārā or Dolma.
(3) A small brass Tibetan Bon idol.
(4) A Chinese cloisonné enamelled bowl, Ming dynasty, Ching Thai period ± 1450.
(5) Three Tibetan tankas (Kakemonos) representing Shakyamuni and Tshepame (Amitāyus).
(6) A Nepali Brass MS. Cover, with five Buddhas in relief.

All exhibited by Johan van Manen.

5. Two Spanish stars of Diamonds and two gold Medals :—Harit Krishna Deb.

6. Asbestos and other geological specimens :—Dr. E H. Pascoe :—

(1) Asbestos Hornblende from Seraikela State. Singhbhum. Asbestos from Idar State.
(2) Limonite bauxite, Bauxite pisolitic, Bauxite pisolitic } from Ranchi district.
Alum prepared by D. Waldie & Co.
Aluminium block.
(3) Cassiterite from Nurunga, Hazaribagh District.
Tin Ingot ,, ,, ,, ,,
(4) Chalcopyrite–Rakha mines.
Copper Ingot. ,,
(5) Columbite—Abraki Pahar, Singar Zemindary, Gya District.
Pitchblende ,, ,, ,,
Uranium ochre ,, ,, ,,
Triplite ,, ,, ,,
Zircon ,, ,, ,,
(6) Phulpur meteorite—Allahabad District.

7. Section of nummulitic limestone from the Khasi Hills :—Hem Chandra Das-Gupta.

8. Two illustrations from life of abnormality in the colouration of Bulbuls of the genus *Molpastes* :—Satya Charan Law.

9. Exhibits of some new organic antimonial compounds.–U. N. Brahmachari, M.A., M.D., Ph D.

(1) NH_4—antimonyl tartrate.
(2) Urea—antimonyl tartrate.
(3) "Stib—amine."
(4) Tri—amino—phenyl—stibinic acid.
(5) Narcotein—antimonyl tartrate.

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10. A huge Palaeolith, a stone-knife, a stone-axe, some unfinished quartzite artifacts and a skull, from Chota Nagpur tracts :—Panchanan Mitra.

The President announced that the next meeting of the Medical Section would be held on Wednesday, 9th February, 1921.

The adjourned meeting of the Medical Section of the Asiatic Society of Bengal was held at the Society's Rooms on Wednesday, the 9th February, 1921, at 9-15 P.M.

DR. UPENDRA NATH BRAHMACHARI, RAI BAHADUR, M.A., M.D., PH.D., F.A.S.B., in the chair.

The following member was present :—

Dr. K. K. Chatterjee.

Visitors:—Dr. S. Bhattacharji, Dr. R. Chakravarti, Dr. N. C. Chatterjee, Dr. P. Chatterjee, Dr. S. K. Chatterjee and others.

The minutes of the meeting held on 8th December 1920 were read and confirmed.

The following papers were read :—

1. *A modification Bassini method for the radical cure of hernia by plication and overlapping of externus obliquus abdominis.—By* DR. K. K. CHATTERJEE.

2. *Radical cure of hydrocele by plication and overlapping of the tunica vaginalis.—By* DR. K. K. CHATTERJEE.

3. *A new bracelet stethoscope for estimating systolic and diastolic blood pressures by the auscultatory method.—By* DR. U. N. BRAHMACHARI.

MARCH, 1921.

The Monthly General Meeting of the Asiatic Society of Bengal was held on Wednesday, the 2nd March, 1921, at 9-15 P.M.

THE HON'BLE JUSTICE SIR ASUTOSH MUKHOPADHYAYA, KT., C.S.I., D.L., D.SC., F.R.S.E., F.A.S.B., President, in the chair.

The following members were present :—

Raja Bahadur Bhupendra N. Sinha, Dr. B. L. Chaudhuri, Dr. W. A. K. Christie, Prof. H. C. Das-Gupta, Mr. T. P. Ghosh,

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Mr. C. L. Jain, Dr. R. C. Majumdar, Mr. J. van Manen, Prof. N. C Chatterjee, Babu H. C. Ray-Chaudhuri.

The minutes of the January Ordinary Monthly General Meeting, the Annual Meeting and the February Ordinary Monthly General Meeting were read and confirmed.

Forty-three presentations were announced.

The Anthropological Secretary submitted a letter from Dr. N. Annandale forwarding copies of the report of the Inaugural meeting of the International Institute of Paris held in Paris in September, 1920.

The President announced that Dr. Baini Prashad had been appointed Biological Secretary during the absence of Dr. S. W. Kemp for about six weeks.

The General Secretary read the names of the following gentlemen who had been appointed to serve on the various committee, during 1921.

Finance Committee.

President, Treasurer, Secretary — *Ex-officio.*
Mahamahopadhyaya Haraprasad Shastri.

Library Committee.

President
Treasurer
Secretary
Anthropological Secretary
Biological Secretary
Physical Science Secretary
The two Philological Secretaries
Medical Secretary
Hon. Librarian
— *Ex-officio.*
Mahamahopadhyaya Haraprasad Shastri.
J. van Manen, Esq.
W. C. Wordsworth, Esq.

Philological Committee.

President, Treasurer, Secretary — *Ex-officio.*
Mahamahopadhyaya Haraprasad Shastri.
Babu Nilmani Chakravarti.
Aga Muhammad Kazim Shirazi.
Dr. Abdulla Al'Ma'mun Suhrawardy.

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H. G. Carter, Esq., M.B.
W. C. Wordsworth, Esq.
Ramaprasad Chanda, Esq.

Hon. Numismatist.

W. E. M. Campbell, Esq.

Hon. Joint Secretaries, Science Congress.

Dr. J. L. Simonsen.
Prof. C. V. Raman.

Building Committee.

President, Treasurer, Secretary } *Ex-officio.*
S. W. Kemp, Esq., B.A., D.Sc.
W. A. K. Christie, Esq., B.Sc., Ph.D.
Mahamahopadhyaya Haraprasad Shastri, C.I.E.
H. A. Crouch, Esq.
Sir R. N. Mukerjee, K.C.I.E.

Publication Committee.

President, Treasurer, Secretary } *Ex-officio.*
Biological Secretary.
Physical Science Secretary.
Anthropological Secretary
Hon. Librarian.
The two Philological Secretaries.

The President reported the death of Prof. E. B. Tylor, an Honorary Fellow of the Society.

Mr. Ramaprasad Chanda read an obituary notice of Prof. Tylor.

The following gentleman was balloted for and elected an Honorary Fellow :—

Dr. F. W. Thomas.

The following gentlemen were balloted for and elected as ordinary members :—

(1) *Lieut.-Col. G. C. Sturrock*, Royal Artillery, Director of Ordnance Factories, 14, Park Mansions, proposed by Dr. W. A. K. Christie, seconded by Dr. S. W. Kemp; (2) *S. P. Agharkar, Esq., M.A., Ph.D, F.L.S.*, Professor of Botany, Calcutta University, 35, Ballygunj Circular Road, proposed by

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Mr. Hem Chandra Das-Gupta, seconded by Dr. B. Prashad; (3) *Major H. W. Acton, I.M.S.*, Professor of Pathology, School of Tropical Medicine, proposed by Dr. U. N. Brahmachari, seconded by Mr. A. H. Harley.

The following papers were read :—

1. *Ismailitica.—By* W. IVANOW.

2. *Some foreign affinities in Prehistoric India.—By* PANCHANAN MITRA.

3. *Successors of Kumaragupta I.—By* R. C. MAJUMDAR.

4. *On the Antiquity of the term Gauda.—By* N. G. MAJUMDAR.

No. 1 will be published in the *Memoirs* and No. 3 has been published in the *Journal*.

The president announced that the next meeting of the Medical Section would be held on Wednesday, the 9th March, 1921.

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The adjourned meeting of the Medical Section of the Asiatic Society of Bengal was held at the Society's Rooms on Wednesday, the 9th March, 1921, at 9-15 P.M.

DR. CHARLES A. BENTLEY, M.B., D.P.H., in the chair.

The following members were present :—

Dr. U. N Brahmachari, and Dr. J. J. Campos.

Visitors :—Dr. H. W. Acton, Col. J. Megaw, Dr. L. E. Napier, and Dr. W. O. Walker.

The minutes of the meeting held on 9th February, 1922, were read and confirmed.

The following papers were read :—

1. *The Parasite-ridden Population of the Tropics.—By* MAJOR H. W. ACTON.

2. *On Chronic Lead-poisoning in the Printing Presses of Calcutta.—By* DR. J. J. CAMPOS.

—◇—

APRIL, 1921.

The Monthly General Meeting of the Asiatic Society of Bengal was held on Wednesday, the 6th April, 1921, at 9-15 P.M.

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THE HON'BLE JUSTICE SIR ASUTOSH MUKHOPADHYAYA, KT., C.S.I., D.L., D.Sc., F.R.S.E., F.A.S.B., President, in the chair.

The following members were present :—

Maulvi Abdul Wali, Prof. S. R. Bose, Babu Chhote Lall Jain, Dr W. A. K. Christie, Dr. B. L. Chaudhuri, Prof. H. C. Das-Gupta, Mr. H. K. Deb, Prof. S. C. Kar, Dr. R. C. Majumdar, Mr. Johan van Manen, Prof. Narendra Kumar Majumdar, Prof. Nirmal Chandra Chatterjee, Mr. H. C. Roy-Chaudhuri, Prof. Satyendra Nath Basu, Babu Subodh Chandra Mukerjee.

Visitors :—Kumar Gangananda Sinha, Mr. Md. Shahidullah and others.

The minutes of the last meeting were read and confirmed.

Thirty-one presentations were announced.

The President announced that Mr. Ramaprasad Chanda had been appointed Joint Philological Secretary during the absence of Dr. D. R. Bhandarkar up to the middle of June.

The President also announced that Dr. S. W. Kemp had taken over the office of the Biological Secretary from Dr. Baini Prashad.

The General Secretary reported the death of Babu Pratapa Chandra Ghosha, Shaikh Laiq Ahmad Ansari, and Dr. Suresh Prosad Sarvadhikari, ordinary members of the Society.

The following papers were read :—

1. *A vocabulary of current Bengali words not included in ordinary dictionaries and of words used in a new sense.—By* F. E. PARGITER.

2. *Contributions to the History and Ethnology of North-Eastern India, III.—By* H. E. STAPLETON.

3. *The Genus* Cerebella *in India.—By* L. S. SUBRAMANIAM.

4. *The custom of circumcision among the Dravidians.—By* MUHAMMAD SHAHIDULLAH.

5. *Manava Sulba Sutram.—By* NARENDRA KUMAR MAJUMDAR.

No. 1 will be published in the Memoirs and No. 2 in the Journal; Nos. 3 and 4 have already been published in the Journal.

The President announced that the next meeting of the Medical Section would be held on Wednesday, the 13th April, 1921.

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MAY, 1921.

The Monthly General Meeting of the Asiatic Society of Bengal was held on Wednesday, the 4th May, 1921, at 9-15 P.M.

THE HON'BLE JUSTICE SIR ASUTOSH MUKHOPADHYAYA, KT., C.S.I., D.L., D.Sc., F.R.S.E., F.A.S.B., President, in the chair.

The following members were present :—

Maulavi Abdul Wali, Babu Chattu Lal Jain, Dr. W. A. K. Christie, Prof. H. C. Das-Gupta, Dr. A. Foucher, Dr. S. W. Kemp, Mr. J. van Manen, Prof. Panchanan Mitra, Dr. B. Prashad, Prof. Ramaprasad Chanda, Lt.-Col. G. C. Sturrock and others.

The minutes of the last meeting were read and confirmed.

Twenty-eight presentations were announced.

The General Secretary reported that the Rev. Anagarika Dharmapala had expressed a desire to withdraw from the Society.

The following gentlemen were balloted for and elected as ordinary members :—

(1) *Lieut.-Col. F. A. F. Bernardo, C.B.E., C.I.E., M.D.-F.R.C.S., F.R.C.P., I.M.S.*, Officiating Principal, Medical College, Calcutta, proposed by Dr. U. N. Brahmachari, seconded by Mr. A. H. Harley ; (2) *Madan Mohan Burman, Esq.*, Merchant and Landlord, 145, Harrison Road, Calcutta, proposed by Mahamahopadhyaya Haraprasad Shastri, seconded by Prof. N. Chakravarti ; (3) *P. J. Hartog, Esq., C.I.E.*, Vice-Chancellor, Dacca University, Ramna, Dacca, proposed by Mr. A. H. Harley, seconded by Mahamahopadhyaya Haraprasad Shastri.

The following papers were read :—

1. *Zoological Results of a tour in the Far East. Amphipoda, with notes on an additional species of Isopoda.—By* W. M. TATTERSALL. (Communicated by the Biological Secretary.)

2. *On the discovery of the Neolithic Indian Script.—By* HEM CH. DAS-GUPTA.

3. *A short note on the instances of Syncarpy in* Magnifera indica L. *and some other Tropical Plants.—By* P. M. DEBBERMAN. (Communicated by the Biological Secretary.)

4. *Notes on the Venous System of* Varanus bengalensis.—*By* D. R. BHATTACHARYA. (Communicated by the Biological Secretary.)

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These papers with the exception of No. 3 will be published by the Society.

The President announced that there would be no meeting of the Medical Section during this month.

JUNE, 1921

The Monthly General Meeting of the Asiatic Society of Bengal was held on Wednesday, the 1st June, 1921, at 9-15 P.M.

THE HON'BLE JUSTICE SIR ASUTOSH MUKHOPADHYAYA, KT., C.S.I., D.L., D.Sc., F.R.S.E., F.A.S.B., President, in the chair.

The following members were present :—

Prof. R. P. Chanda, Mr. Chhote Lall Jain, Dr. W. A. K. Christie, Mr. K. N. Dikshit, Dr. S. W. Kemp, Prof. N. C. Chatterjee, and others.

The minutes of the last meeting were read and confirmed.

Twenty-one presentations were announced.

The President announced that Dr. W. A. K. Christie had been appointed Honorary General Secretary during the absence of Mr. A. H. Harley.

The following gentlemen were balloted for and elected as ordinary members :—

(1) *Maulavi S Barkat Ali*, Chief Maulavi, Board of Examiners, No. 105, Lower Chitpore Road, Calcutta, proposed by Mr. A. H. Harley, seconded by the Hon. Justice Sir Asutosh Mukhopadhyaya, Kt.; (2) *Prof. Jyotis Chandra Ghatak, M.A.*, Professor of Sanskrit, Bangabasi College, 5, Boloram Bose Ghat Road, Bhawanipur, Calcutta, proposed by the Hon. Justice Sir Asutosh Mukhupadhyaya, Kt., seconded by Mr. A. H. Harley; (3) *The Hon. Nawab Mohammad Muzamullah Khan, Khan Bahadur*, O.B.E., Taluqdar, Aligarh, proposed by the Hon. Justice Sir Asutosh Mukhopadhyaya, Kt., seconded by Dr. A. Suhrawardy, M.L.C.

The following papers were read :—

1. *Contributions to the History and Ethnology of North-Eastern India, III.—The Origin of the Catholic Christians of Eastern Bengal.—By* H. E. STAPLETON.

2. *On the "Renal Portal" system (renal venous meshwork) and kidney excretion in Vertebrata.—By* W. N. F. WOODLAND : communicated by the Biological Secretary.

Both these papers will be published in the *Journal*.

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The President announced that there would be no meeting of the Medical Section this month.

JULY, 1921.

The Monthly General Meeting of the Asiatic Society of Bengal was held on Wednesday, the 6th July, 1921, at 9-15 P.M.

THE HON'BLE JUSTICE SIR ASUTOSH MUKHOPADHYAYA, KT., C.S.I., D.L., D.SC., F.R.S.E., F.A.S.B., President, in the chair.

The following members were present:—

Maulavi Abdul Wali, Babu Bisveswar Bhattacharya, Dr. J. J. Campos, Prof. R. P. Chanda, Prof. H. C. Das-Gupta, Mr. K. N. Dikshit, Mr. T. O. D. Dunn, Dr. L. L. Fermor, Mr. N. G. Majumdar, Prof. N. C. Chatterjee, Babu Rama Prasad Mookerjee, Babu Sasadhar Ray, Mr. J van Manen and others.

Visitors:—Mr. L. Bragamen, Mr. P. de Branganza Cunha, and others.

Twenty-three presentations were announced.

The General Secretary reported that Mr. G. R. Kaye had expressed a desire to withdraw from the Society.

The following gentleman was balloted for and elected as an ordinary member:—

Netai Charan Law Esq., Merchant, 56, Sukea's Street, Calcutta, proposed by Mr. Bimala Charan Law, seconded by Mr. Satya Charan Law.

The following papers were read:—

1. *Primogeniture in Ancient India.—By* N. C. CHATTERJEE.

2. *On some matter concerning the Andhau Inscriptions.—By* N. G. MAJUMDAR.

3. *Two Kharoshthi Inscriptions.—By* N. G. MAJUMDAR.

Nos. 1 and 3 will be published in the *Journal*.

The President announced that there would be no meeting of the Medical Section this month.

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AUGUST, 1921.

The Monthly General Meeting of the Asiatic Society of Bengal was held on Wednesday, the 3rd August, 1921, at 9-15 P.M.

THE HON'BLE JUSTICE SIR ASUTOSH MUKHOPADHYAYA, KT., C.S.I., D.L., D.Sc., F.R.S.E., F.A.S.B., President, in the chair.

The following members were present :—

Prof. S. N. Bal, Prof. S. R. Bose, Dr. U. N. Brahmachari, Dr. W. A. K. Christie, Prof. N. C. Chatterjee, Mr. K. N. Dikshit, Mr. C. S Fox, Mr. A. H. Harley, Dr. S. W. Kemp, Mr. N. G Majumdar, Prof. H. W. B. Moreno, Dr. B. Prashad, Babu Ramaprasad Chanda, Mr. M. J. Seth.

Visitors :—Mr. N. R. Chatterjee, Mr. S. C. Chaudhury, Mr. B. N. Hajra, and others.

The minutes of the last meeting were read and confirmed.

Eighteen presentations were announced.

The General Secretary reported that Mr. W. W. Hornell had expressed a desire to withdraw from the Society.

The President announced that Kumar Sarat Kumar Roy had been appointed member of the Council in place of Dr. R. C. Majumdar, resigned and that the names of Dr. L. L. Fermor and Prof. R. C. Mahalanobis had been added to the Finance Committee for the current year.

The President also announced that Mr. A. H. Harley had resumed charge from Dr. W. A. K. Christie of the duties of the General Secretary.

The following papers were read :—

1. *A note on the newly discovered (Bogra) Stone-Inscription.—By* HARIDAS MITRA.

2. *Notes on Kharosthi Inscriptions.—By* N. G. MAJUMDAR.

3. *The Oldest Christian Tomb in Northern India and the United Provinces.—By* MESROVB J. SETH.

4. *On some new Organic Antimonial Compounds.—By* U. N. BRAHMACHARI, AND S. C. CHAUDHURY.

5. *Observations on the Bat-Flowers of the Mohwa* (Bassia latifolia).—*By* MAUDE L. CLEGHORN.

All these papers except No. 4 will be published in the *Journal*.

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The President announced that there would be no meeting of the Medical Section this month.

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SEPTEMBER, 1921.

The Monthly General Meeting of the Asiatic Society of Bengal was held on Wednesday, the 7th September, 1921, at 9-15 P.M.

THE HON'BLE JUSTICE SIR ASUTOSH MOOKERJEE, KT., C.S.I., D.L., D.Sc., F.R.S.E., F.A.S.B., President, in the chair.

The following members were present :—

Prof. S. N. Bal, Dr. W. A. K. Christie, Mr. K. N. Dikshit, Babu Harit Krishna Deb, Mr. A. H. Harley, Mr. H. Cecil Jones, Dr. S. W. Kemp, Mr. N. G. Majumdar, Mr. N. C. Chatterji.

Visitors :—Mr. Sudhindra Chandra Sinha-Sarma, and others.

The minutes of the last meeting were read and confirmed.

Seventeen presentations were announced.

The General Secretary reported that the Hon'ble Rev. W. K. Firminger and Mr. W. E. Andrews had expressed a desire to withdraw from the Society.

The President announced that the names of the following five members being largely in arrears with their subscriptions had been declared defaulters and that their names would be posted in accordance with Rule 28 :—

	Rs.
Abdul Kalam Mohyudin Ahmed Azad ..	150
Babu Rama Nath Khanna	66
Kazunobu Konokagi	60
Pandit Harnarayan Shastri	60
Babu Daya Ram Sahni	72

The President also announced that Dr. D. R. Bhandarkar had resumed charge from Mr. Ramaprasad Chanda of the duties of the Joint Philological Secretary.

The following gentlemen were balloted for and elected as ordinary members :—

(1) *Hemchandra Ray, Esq.*, Lecturer in Ancient Indian History, Calcutta, University, 5/1, Fakirchand Mitter's Street, proposed by Mr. P. D. R. Bhandarkar, seconded by Mr. Hemchandra Roy-Chaudhuri ; (2) *Praphulla Krishna Deb, Esq.*

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Zemindar and Landholder, 106/1, Grey Street, Calcutta, proposed by Mr. Khagendra Bhusan Roy, seconded by Harit Krishna Deb.

The following papers were read :—

1. *Sarala and Devadaru.—By* JYOTISCHANDRA GHATAK. Communicated by N. G. Majumdar.

2. *Maner Copperplate of Govindachandra, dated V.E.* 1183.—*By* N. G. MAJUMDAR.

3. *The Rig-Veda—A note on the arrangement of the Book.—By* G. R. KAYE.

4. *Three Tibetan Repartee*—Songs.—*By* J. van MANEN.

All these papers except No. 1 will be published in the *Journal*.

The President announced that there would be no meeting of the Medical Section this month.

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DECEMBER, 1921.

The monthly General Meeting of the Asiatic Society of Bengal was held on Wednesday, the 7th December, 1921, at 9-15 P.M.

THE HON'BLE JUSTICE SIR ASUTOSH MUKHOPADHYAYA, KT., C.S.I., D.L., D.Sc., F.R.S.E., F.A.S.B., President, in the chair.

The following members were present :—

Khan Sahib M. Abdul Wali, Dr. S. P. Agharkar, Prof. S. N. Bal, Dr. D. R. Bhandarkar, Prof. R. P. Chanda, Prof. N. C. Chatterjee, Mr. H. Bruce Hannah, Mr. Harit Krishna Deb, Prof. H. C. Das-Gupta, Mr. Hem Ch. Roy, Prof. J. C. Ghatak, Mr. J. van Manen, Kumar Prafulla Krishna Deb, Kumar S. K. Roy.

Visitors :—Mr. P. C. Bagchi and others.

The minutes of the last meeting were read and confirmed.

Sixty presentations were announced.

The President reported the death of Mr. J. N. Das-Gupta, B.A., a Life member, and Lt.-Col. C. T. Peters (retd.) an Ordinary member of the Society.

The General Secretary reported that the Hon'ble Justice T. W. Richardson and Lt.-Col. E. H. Brown, had expressed a desire to withdraw from the Society.

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The General Secretary laid on the table certain leave rules recommended by Council to the Society's Staff.

The President announced that the names of the following five members being largely in arrears with their subscriptions had been posted as defaulters since the last meeting and that their names have now been removed from the member-list.

	Rs.
Mr. Abdul Kalam Mohyudin Ahmed Azad ..	150
Babu Rama Nath Khanna	66
Mr. Kazunobu Kanokagi	60
Pt. Harnarayan Shastri	60
Babu Daya Ram Sahni	72

The President also announced that the following member being largely in arrears with his subscriptions has been declared a defaulter and that his name has been posted in accordance with Rule 38.

Babu Kashi Nath Das .. .. Rs. 59.

The following gentlemen were elected ordinary members during the recess in accordance with Rule 7 :—

S. L. Hora, Esq., M.Sc.
W. R. C. Brierley, Esq.
R. C. Prendergast, Esq.
Shah Emdadul Haq, Esq., M.L.C.

The following gentlemen were balloted for and elected as ordinary members :—

(1) *R. A. Tilang Esq.*, Professor of History, Benares Hindu University, Benares City, proposed by Dr. D. R. Bhandarkar, seconded by Mr. Ramaprasad Chanda; (2) *Kumar Anand Kumar, M.A.*, Bar-at-law, Reader in Zoology in the Punjab University, Fairfields, Ferozpore Road, Lahore, proposed by Dr. Baini Prashad, seconded by Dr. S. W. Kemp; (3) *B. A. Barua, Esq.*, Lecturer, Calcutta University, 4, Herambi Ch. Das's Lane, Off Mechuabazar Street, Calcutta, proposed by Dr. D. R. Bhandarkar, seconded by Mr. Ramaprasad Chanda.

The following papers were read :—

1. *Determination of the Molecular formula of the binary compounds of inorganic substances.*—*By* DURGAPADA MISRA.

2. *The Dhupi Copperplate Inscription of Ramasimha, Sakābdā*, 1720 (*A.D.* 1798).—*By* K. M. GUPTA.

3. *The Sue Vihar Copperplate of the Reign of Kaniska.*—*By* N. G. MAJUMDAR.

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4. *The Prakrit Dhata-Adesas.*—*By* Sir Geo. A. Grierson.

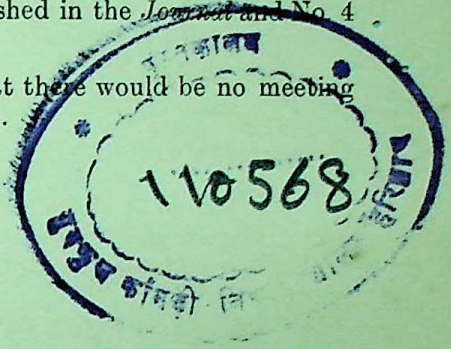
5. *Concerning a Bon Image.*—*By* Johan van Manen.

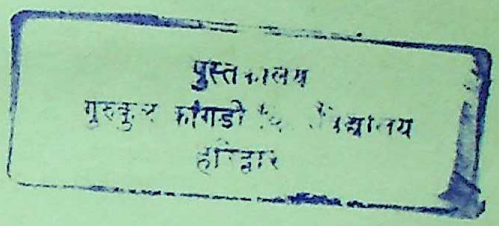
6. *An improved method of Wheat-sewing for Central India.* —*By* K. R. Joshi.

7. *Madra.*—*By* H. C. Ray.

Nos 2, 5 and 7 will be published in the *Journal* and No. 4 in the *Memoirs*.

The President announced that there would be no meeting of the Medical Section this month.





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PRINCIPAL PUBLICATIONS OF THE SOCIETY.

Asiatic Researches, Vols. I—XX and Index, 1788—1839.
Proceedings, 1865—1904 (now amalgamated with Journal).
Memoirs, Vol. 1, *etc.*, 1905, *etc.*
Journal, Vols. 1—73, 1832—1904.
Journal and Proceedings [*N. S.*], Vol. 1, *etc.*, 1905, *etc.*
Centenary Review, 1784—1883.
Bibliotheca Indica, 1848, *etc.*

A complete list of publications sold by the Society can be obtained on application to the Honorary Secretary, 1, Park Street, Calcutta.

PRIVILEGES OF ORDINARY MEMBERS.

(*a*) To be present and vote at all General Meetings, which are held on the first Wednesday in each month except in September and October.

(*b*) To propose and second candidates for Ordinary Membership.

(*c*) To introduce visitors at the Ordinary General Meetings and to the grounds and public rooms of the Society during the hours they are open to members.

(*d*) To have personal access to the Library and other public rooms of the Society, and to examine its collections.

(*e*) To take out books, plates and manuscripts from the Library.

(*f*) To receive *gratis* copies of the *Journal and Proceedings* and *Memoirs* of the Society.

(*g*) To fill any office in the Society on being duly elected thereto.

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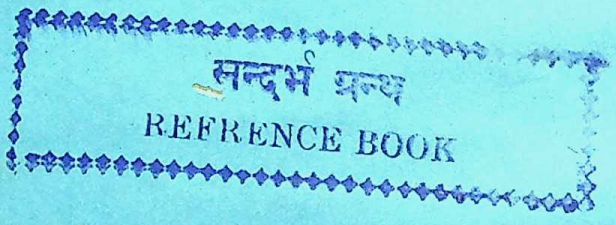

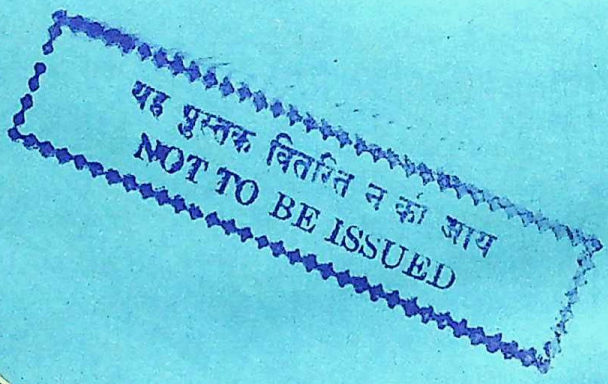

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